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THE USE OF CONDUCTIVE ANESTHESIA IN INTRAORAL OPERATIONS.*

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The use of local anesthesia in minor operations and in certain major operations where it is especially indicated, is fast superseding general anesthesia in oral surgery. The recent development of novocain and suprarenin has placed this combination on as firm a foundation in surgical practice as the time-honored chloroform, ether and nitrous oxid.

Local anesthesia is especially indicated in those conditions where the nerve supply of the part is readily accessible to the needle. By injecting novocain into or around the nerve trunk supplying the part, an anesthesia can be produced in all the parts of the nerve peripheral to the injection. The essential principle of conductive anesthesia is to deposit the anesthetizing solution in the closest proximity to the nerve supplying the part, hence an accurate knowledge of the anatomy of the nerves supplying that part is necessary for rational procedures.

There are certain other principles to which we must adhere if we are to expect perfect results. We must use an anesthetic that we can inject in quantity without great danger of toxic effects. At the present time, one to two per cent novocain most nearly fills this requirement. The solution injected must keep the operative field anesthetized for a sufficiently long time, which phenomenon is produced by the use of suprarenin in varying percentage suitable to the needs of the operation. To get the best results it is necessary to have the solution injected resemble as nearly as possible a physiological solution in order that it will be absorbed by the tissues quickly and easily without the tumefaction or dehydration of the cells produced by too low or too high percentage solutions. Before a painless operation can be performed it is absolutely necessary to wait until the solution has passed through the perineurium and anesthetized the axones contained in the centre of the nerve. On the periphery this waiting period may be only a few seconds or few minutes at the most, but in conductive anesthesia of the inferior dental nerve, for instance, it is absolutely necessary to wait fifteen or twenty minutes before the solution has penetrated to the center of the nerve. The length of this time is lessened by the proximity of the solution to the nerve and by the use of a physiological solution in order that the absorption may be more rapid.

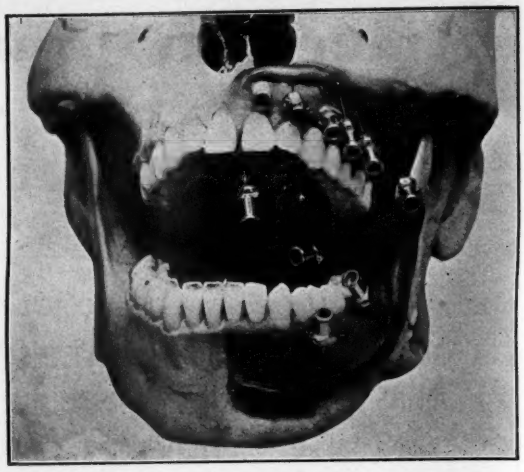

Fig. 1. Injection of the mandibular nerve, mental nerve, and dental nerves of the upper teeth. Note relations of the soft tissues in the posterior part of the mouth to the needle.

In conductive anesthesia of the mouth it is necessary to avoid as much post-operative pain and discomfort as possible. There are several causes of post-operative pain. Perhaps the greatest cause is the use of needles of too large diameter. Pain in other parts of the body is in direct proportion to the extent of the traumatism and the richness of the nerve supply. In the mouth we have a particularly sensitive area to work upon and it is necessary, to obtain the best results, that we effect our injection with as little disturbance to the tissues as possible. An iridio-platinum needle of twenty-two gauge is large enough for any injection in the mouth and will not give rise to untoward sequences if properly handled. Injections in the internal pterygoid muscle when blocking the lower jaw may occur if the needle is not held at least 1cm. above the plane of the lower teeth. This will result in painful use of the muscle and in a trismus lasting a few hours or days. If the syringe is kept in alcohol it should be thoroughly rinsed, as the alcohol will cause pain and prolonged anesthesia as is noted when alcohol is used in the treatment of trifacial neuralgia. Failure to use a normal physiological solution will cause post-operative pain from the tumefaction or dehydration induced in the cells. Discolored solutions caused by oxidized adrenalin and suprarenin, the introduction of septic matter with the needle, the failure to use freshly distilled water in preparing the solution, are given as causes of post-operative pain, but it is assumed that the principles of surgical cleanliness will be used in this method as it is used in general remedial measures.

Conductive anesthesia is especially suited for op-

* Read during the Organization Meeting of the Interstate Association of Anesthetists in Cincinnati, May 4-5, 1915.

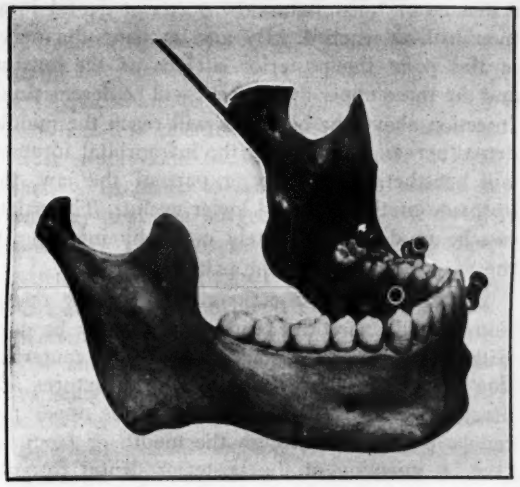

Fig. 2. Relation of the needle in the ptyergo-mandibular space. The needles in the anterior part of the jaw show the injections for treating pyorrhea of the lower anterior teeth.

erations in the mouth. The nerves supplying the structures of the jaws are readily accessible to the needle when their correct location is known. Except for the mandibular nerve the terminal branches of the trifacial are of very small diameter which prevents an undue loss of time in waiting for the part to become sufficiently numb for operative work. A great advantage is that there are no large vessels or delicate organs in the neighborhood of the injection, which precludes any ill effects or accidents which might be present in other parts of the body.

The lower jaw is supplied with the mandibular nerve which passes obliquely outward and forward from the foramen ovale to the inferior dental foramen. The whole half of the mandible is supplied by this nerve except a small area of the mucous membrane on the buccal of the lower molars. The lingual nerve, a branch of the mandibular, supplies the lingual surface of the mandible and also the tongue. This nerve may be anesthetized by the same injection for the mandibular nerve.

The position of the inferior dental foramen varies slightly in different individuals. In young patients where the angle of the jaw is nearly 90 degrees the foramen is somewhat higher than in elderly patients where the angle is more obtuse. Likewise the angle formed by the union of the ramus and the body of the mandible varies in different individuals. These differences may be ascertained by careful observations before making the injection.

To inject the right mandibular nerve, for example, the external oblique line of the ramus is palpated with the index finger of the left hand. The finger is then moved mesially until the rounded edge of the internal oblique line is found and the finger is then allowed to rest in the interval between these lines. The point of the needle should be inserted 1cm. or approximately a finger's breadth above the line of the lower teeth at the inner border of the internal oblique lines using the palpating finger as a guide. The needle should not be inserted straight posteriorly but should follow the inner surfaces of the ramus. Experience has shown that resting the barrel of the syringe in the region of the lower cuspid tooth of the opposite side will direct the needle in the proper plane. The patient's mouth should be wide open. Injecting too low will cause a stiffness of the internal pterygoid, injecting too high will result in failure to reach the nerve as it descends obliquely from the skull.

When the needle has been inserted 5 mm. a few drops should be injected to anesthetize the lingual nerve. The needle should then be carried back not further than 1.5cm. where 2cc. should be injected. Then inject 0.25cc. in the mucous membrane external to the molars to reach the buccal nerve, and in twenty minutes the jaw will become so anesthetized that any operation can be done painlessly upon it.

The great advantage of local anesthesia in the mouth is that there is practically no danger of the inspiration of blood. Under a general anesthetic it takes as much time to sponge the blood out of the pharynx as it does to complete the operation. With local anesthesia the patient is conscious, can take care of the blood himself and can even assist in the operation. When a bloodless field is desired suprarenin can be injected around the operative field after it is anesthetized with the result that the area is visible, which is not usually the case otherwise in oral operations.

This method will find approval in nearly every operation on the lower including partial and total resections of the jaw or the alveolar process, but of course in these cases ascending branches of the cervical plexus must be anesthetized. In removing sections of the mandibular nerve, in treatment of trifacial neuralgia, it is valuable. It is also useful in making a diagnosis in these conditions. Tumors are painlessly removed with some degree of pleasure when you are confident that the patient's breathing apparatus will not be flooded with blood. The impacted third molar, a bugbear under a general anesthetic, is removed as easily and sometimes more easily than an ordinary tooth when good access is had by the help of the patient. If conductive anesthesia were used only in the reduction of frac-

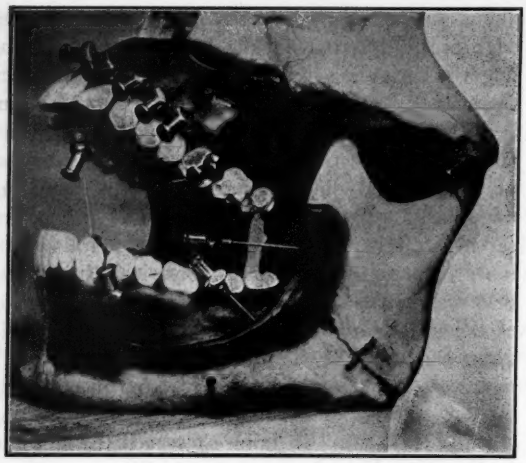

Fig. 3. Injection at the post dental foramen for antrum and upper molars.

tured jaw it would find a sure place in surgery. Formerly it was necessary to completely anesthetize the patient in order to get relaxation of the muscles, while now we can inject novocain at the inferior dental foramen and reduce the fracture easily and painlessly with the patient's assistance. Seldom if ever will it be impossible to inject the nerve through the mouth, but in cases of extensive swelling and traumatism the nerve can be reached by inserting the needle from the outside just behind the posterior border of the ramus.

In the upper jaw the structures are supplied by the superior maxillary and the descending branches of Mechel's ganglion. The superior maxillary nerve leaves the skull by the foramen rotundum, passes through the spheno-maxillary fossa and enters the infraorbital canal. It gives off a communication to Mechel's ganglion and three terminal branches to the jaw, the posterior dental, the middle dental and the anterior dental, besides sending branches to the upper lip, side of the nose, and lower eyelid. Mechel's ganglion, through the descending palatine, accessory palatine and naso palatine nerves, supplies the nasal septum, the lower part of the nasal cavity, the soft palate, tonsils, and hard palate. By careful technic operations on these various parts may be performed painlessly with the patient conscious.

Injection of the superior maxillary nerve is rarely done. It is seldom necessary as the part to be operated upon can usually be controlled by injection of the terminal branches to the nerve. To inject the posterior dental nerve palpate for the malar prominence from the inside the mouth, start the needle in the fold of the cheek opposite the second molar tooth and insert the needle along the bone for a distanc of 1.5cm. when the posterior dental foramen will be reached. By anesthetizing the nerve at this point the posterior surface of the antrum and the three upper molar teeth will be desensitized. Injection above the bicuspids will reach the middle dental nerve. Injection at the infraorbital foramen will anesthetize the anterior part of the jaw, the lips, side of the nose and lower eyelid. The palate can be rendered completely numb by injecting at the anterior and posterior palatine foramen.

By these simple injections many of the operations usually performed under ether may be done with novocain. Resections, removal and cauterization of tumors, extraction of teeth, fractures and practically all the minor surgery of the upper jaw can be performed through the mouth or from the face by injecting at the posterior dental foramen and above the bicuspids. The removal of the floor of the antrum in necrosis under local anesthesia transforms a disagreeable operation to one of comparative ease when the patient can watch the blood.

In hare-lip, the parts can be rendered insensible by injection at the infraorbital foramen. In double hare-lip the central lobe must be injected separately. By this method the union can be made much more satisfactorily when the direction of the muscles can be studied during the operation. Simply sewing a lip together produces a union, but it does not prevent a permanent deformity unless the direction of the muscle fibres be carefully studied and sewed together in their proper relations. The motor supply

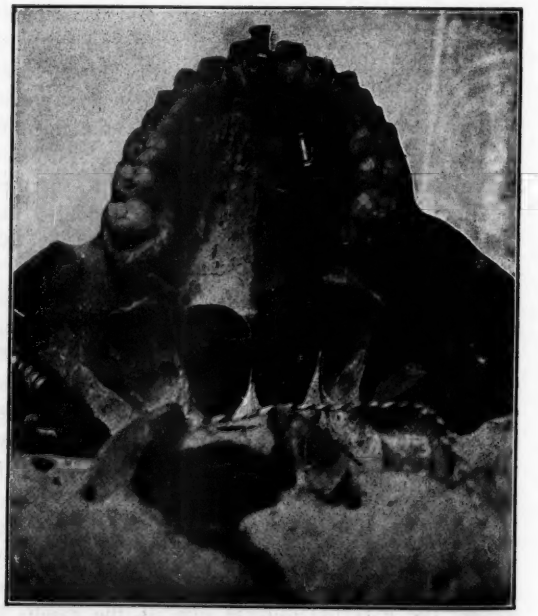

Fig. 4. Injection at anterior and posterior palatine foramina for operations on the palate.

is not affected by this injection allowing movement of the muscles which of course is impossible under a general anesthetic.

Cleft palates are usually attempted at an early age. When this operation is performed later in life it is often done to advantage under a local anesthetic. In order to secure perfect results, it is necessary that the surgeon have all the facilities possible. It is not to his advantage to have the patient's head hanging over the table or turned to one side to keep the blood out of the larynx. The wretching, vomiting, and sickness following ether, or chloroform, which usually results in the stitches being torn out, is entirely eliminated. This is one of the most important factors for a favorable prognosis. This method is particularly advantageous in repairing clefts of the velum, in the correction of a former operation, or in repairing small openings in the hard palate.

The rapid healing of wounds when anesthetized is another advantage. It has been carefully worked out and proven that wounds heal much more quickly when the pain is abolished or when the sensory supply is cut off. Anesthesia in the therapy of inflammation is no longer an experiment but a well proven fact.

The object of this paper is to bring to the attention of the anesthetists present some of the more recent developments along this line of anesthesia of the oral cavity. To cover this subject thoroughly in a single paper is impossible. Rather, it has been the object to outline the various indications of this anesthetic in the mouth and to point out its advantages in certain operations. The mouth has always been a difficult place to operate upon, chiefly because of the unfavorable position on the table and because of the troublesome hemorrhage. With some experience the use of conductive anesthesia will eliminate many of these disadvantages and render our patients an inestimable service.

ANDREWS BUILDING.

DISCUSSION.

DR. BION R. EAST, Detroit, Mich.: There are a few points in Dr. MacMillan's paper which I wish to touch upon. First regarding the use of adrenalin. If used after the injection of cocain or novocain there is remote danger of any toxic effect. However the adrenalin preparations are among the most active drugs known in chemistry, and must be used in minimal dosage and with due discretion. The combination of sodium chloride or any other salt in a tablet which contains adrenalin or suprarenin is unsatisfactory, and, I think, unscientific, for the reason that the salt will absorb moisture enough from the atmosphere to cause deterioration, with consequent bad results if the discolored tablets are used for injected solutions.

After selection of the drug the vehicle which carries it into the tissues is the next in importance after thorough antiseptic precautions have been taken with regard to the syringe and site of injection. Sodium chloride alone is a protoplasmic poison, and requires the addition of calcium and potassium salts; hence the value of freshly prepared Ringer's solution. When a nerve is injured, for instance, or cut, the tissue itself begins at once to deposit potassium salts in the perineural tissues. The more potassium formed the fewer impulses are carried to the brain, which would suggest that we should have the natural local anesthetic in the vehicle which we inject.

Cocain is very toxic when not supported, but when combined with such a drug as chloretone, it seems quite harmless. In the dental clinics in Detroit, where we have extracted 25,000 teeth during the past year, with some of the operators not of great experience, we have yet to discover the toxic action of cocain. Our patients have been children averaging between nine and ten years of age. We have used cocain and chloretone in all cases. We give instructions to our operators to be scrupulously clean.

In agreement with Dr. MacMillan, our experiments on dogs have proven almost conclusively that tissues heal more rapidly if they can be kept obtunded. A most important thing in local anesthesia is to operate shortly after a meal and never on an empty stomach. I am riding the hobby of conductive anesthesia very hard, teaching it continually, and in my personal use and in my observations of the work of my associates I have yet to observe any bad results.

COLOR CHANGES AND THE MARGIN OF SAFETY IN NITROUS OXID ANESTHESIA.*

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The effect upon respiration of variations in the oxygen and carbon dioxid tensions in the blood is of fundamental importance in the scientific study of narcosis. Especially is this true in the case of nitrous oxid anesthesia, where the mildly depressant action of the gas is modified by factors peculiar to the use of a closed system and to the consequent extension of the dead-space of the lungs. Here we are called upon to regulate the partial pressures of at least three gases: (1), nitrous oxid; (2), oxygen, and (3) carbon dioxid; and occasionally a fourth, ether-vapor.

In the old days of the cone, it was customary to reduce the patients to unconsciousness by a method of partial asphyxiation. This effect was produced not only by administering an overwhelming initial dose of the anesthetic, but also in large part by the exclusion of oxygen. More or less cyanosis was the rule, and the excitement, and convulsive struggles so commonly described in the text-books as concomitant with the inductive stage of anesthesia, appear in the light of present day results to have been the effect more of the method than of the anesthetic. The signs of the primary stage were in many cases really the signs of asphyxia.

The extensive adoption of nitrous oxid anesthesia in the majority of large surgical clinics today, thanks to the pioneer work of Teter, Gwathmey, Gatch, McKesson and others, has re-introduced the problems of the so-called *closed method*. Gatch in his work on re-breathing has shown that the advantages of this system exceed those of any open method, and that the dangers if fully appreciated may be easily avoided. But are they fully appreciated?

Briefly the dangers of this system are three: (1), over-concentration of the anesthetic; (2), over-

* Read during the Third Annual Meeting of the American Association of Anesthetists, San Francisco, Cal., June 21, 1915.

ventilation of the lungs with consequent loss of carbon dioxid resulting in acapnia, apnea, and even shock; (3), deficiency of oxygen leading to anoxemia, asphyxia and respiratory paralysis.

It is my purpose here to review some recent epochal work on the physiology of respiration, which has opened up fresh vistas in clinical medicine and from this new viewpoint, to reconsider the dangers of the closed system, and their encroaching limitations on the margin of safety in nitrous oxid anesthesia. These observations will apply particularly to cases of great or increased surgical risk. By its very safety nitrous oxid has become the anesthetic of choice in an ever-increasing number of patients with serious pathological lesions and abnormal metabolism. It is this class above all, of serious, often desperate risk, which raises the mortality ratio. In fact, I believe these patients are the chief and practically the only concern of anesthetists proficient in the use of nitrous oxid. In all of them, let me repeat, metabolism is seriously disturbed; consequently the final oxidations are incomplete and acid-products tend to accumulate in the blood. There is an increasing strain upon the channels of elimination. The effect of this upon respiration and the carbon dioxid tension in the blood and alveolar air will be evident further on.

What I wish to emphasize here is: *First*—That the real danger in these cases is anoxemia or oxygen-lack; even very slight degrees of oxygen starvation being injurious if long continued. *Second*—That the warning sign of anoxemia is cyanosis, and the importance of careful observation and control of the patient's color can not be reiterated too often. This means the avoidance of prolonged cyanosis even in the slightest degree.

I am well aware that the dangers of asphyxia have been remarked before. Thus Gwathmey has succinctly epitomized the margin of safety in these words: *"If the patient is kept free from cyanosis and the anesthetist knows the difference between asphyxiation and anesthesia, a death from nitrous oxid and oxygen is impossible."* But it may be asked how shall we recognize very slight minimal degrees of asphyxia? Gatch also has repeatedly warned against cyanosis, particularly when patients with cardio-vascular lesions are subjected to the Trendelenburg position. Obviously any anesthetist will endeavor to avoid marked cyanosis and other outspoken evidences of asphyxia. But the tendency to reenforce the action of the anesthetic with very slight degrees of asphyxia is constantly present in a closed system. Connell has shown that the depth of anesthesia increases directly as the oxygen decreases, and that with nitrous oxid the zone of anesthesia in which the color, blood-pressure and respiration are normal, is frequently too light a zone for deep abdominal surgery unless supplemented by morphine narcosis, small quantities of ether, or local analgesia. And I postulate here that it is far better to reenforce the action of the gas with a small amount of ether than to produce surgical anesthesia by cutting down the oxygen supply.

PHYSIOLOGY OF THE RESPIRATORY CENTER.

Physiologists have long been divided into two camps over the question whether oxygen-lack or carbon dioxid-excess is the real intrinsic stimulus to the respiratory center. Rosenthal in the past championed the former view, while among present-day workers Haldane and Henderson have presented convincing evidence that slight changes in the carbon dioxid tension alter the respiratory rhythm. While it has been generally conceded that the center is more sensitive to slight changes in carbon dioxid tension than to corresponding variations in oxygen—the actual part played by the oxygen-tension has not been clear. Thus, although Lindhard has recently claimed that lowering the oxygen tension increases the excitability of the center, Henderson on the other hand has asserted that the function of oxygen is merely nutritive and that absence of oxygen paralyzes the neurones. This author further emphasizes the importance of carbon dioxid as the normal stimulus not only to the neurones, but peripherally to the cardiac, vascular, and intestinal muscles. In his work Henderson sought to demonstrate the existence of a veno-pressor mechanism. He emphasized the importance of carbon dioxid in maintaining the tonus of this system and warned against the dangers of over-ventilation and acapnia. More recently, Hooker at Johns Hopkins, while not denying that the total output of the heart is increased by small percentages of carbon dioxid, gives evidence to show that this increase is really due to relaxation of the pulmonary bed, and demonstrates conclusively that oxygen is essential to rhythmicity and tone in vascular muscle. Although his experiments show that carbon dioxid even in small percentages may depress cardiac muscle and relax vascular tone, he admits that the total effect may be beneficial, since the stimulating action of carbon dioxid on the medullary centers more than compensates for its depressant action peripherally.

Divergent as these various views may appear, it seems fair to conclude they are but reverse sides of the same shield, and that oxygen-lack, carbon dioxid-excess, and weak acids, may all act upon the center in the same way. The work of Hassel-

bach has put a period to much of this uncertainty by showing that the common factor underlying these various agencies is the regulation of the reaction of the blood, or as the physical chemists express it: *the H-ion concentration.*

Adopting Winterstein's hypothesis, Hasselbach demonstrated that changes in the carbon dioxid tension of the blood is one of the means by which the body maintains the normal neutral reaction of the blood and thereby protects itself against acidosis.

Carbon dioxid is, as we know, a weak acid and exists in the blood in such readily dissociable forms as the carbonate and bi-carbonate of sodium. These compounds by interplay with the sodium phosphates and proteins, are held in a state of delicate chemical equilibrium. Now if the acid-products of metabolism are augmented, some of the carbon dioxid is washed out of the blood through the lungs; more basic ions are liberated to neutralize the acid, and thus the H-ion concentration is maintained at its normal level. In this mechanism it is the specific function of the kidneys to separate the acid-radical from the base, and excrete the acid, thus preserving the sodium base for the body.

It is evident from these newer contributions that the real stimulus to the respiratory center is the H-ion concentration of the blood, and that in the regulation of this protective mechanism, the lungs play a rôle only second to the kidneys in importance.

An increase in acidity is forestalled by a change in the respiratory rhythm and consequent washing out of carbon dioxid from the blood. So it will be seen that lungs, kidneys, circulating system, and respiratory center are all intricately related and delicately coordinated in a protective mechanism whose function is to preserve the normal neutral reaction of the blood and prevent acidosis. The lungs have been described as *the more delicate balance wheel of this regulatory mechanism.*

With these facts in mind we are now in a position to review the dangers of the closed system and their effect upon the margin of safety in that large class of patients in whom the risk is increased by disturbances in metabolism. These dangers we have stated to be:

(1) Acapnia
(2) Over-concentration of the anesthetic, and
(3) Anoxemia

ACAPNIA.

According to Henderson, carbon dioxid is the normal stimulus to the medullary centers and peripherally promotes rhythmicity and maintains the tonus of involuntary, cardiac and vascular muscles. If by excessive ventilation of the lungs, as in hyperpnoea, this normal stimulus is greatly reduced in tension, the resulting acapnia will upset the normal osmotic tension in the fluids and tissues of the body, causing loss of fluid and tonus and terminating in a condition of surgical shock.

The recent investigations of Hasselbach and others which I have summarized would seem to indicate that Henderson's premises are not altogether complete and it is possible that his conclusions must be modified accordingly. Furthermore, Mann and his coworkers were unable to demonstrate experimentally that acapnia is a primary factor in the production of shock. Clinically it is a well known fact that in many individuals, a physiological apnea cannot be produced by hyperpnoea. Boothby has stated that in these cases there is a compensatory diminution of the circulation through the respiratory center, in consequence of which the gas-tensions are still capable of exciting the center, and he suggests that in shock due to forced ventilation there is an added factor of oxygen-lack.

Hoover and Gammon have recently shown that forced breathing is not so effectual in ventilating the lungs as has been thought. The optimum of respiratory volume is 1200 c.c. If the respiratory volume is increased beyond this amount, the effectiveness of ventilation does not increase proportionately with the increase in the volume of ventilating air. It may be questioned therefore whether it is physically possible to lower the carbon dioxid tension to an alarming degree by forced ventilation. On the other hand, as Hasselbach has shown, a lowering of the carbon dioxid tension may be an actual protection against acidosis where there is abnormal acid production. It seems fair to conclude therefore that the dangers of acapnia have been exaggerated, and this conclusion is supported clinically by the experience of many anesthetists. Certainly we have little to fear from acapnia in the course of a well conducted anesthesia, particularly if we employ with intelligence some method of rebreathing.

REBREATHING.

Aside from the question of its peripheral action, the stimulating effect of carbon dioxid upon the medullary centers is convincing evidence as to the value of rebreathing. Clinically this fact is evident enough, and it is unquestionable that rebreathing small percentages of carbon dioxid is an efficient means of raising blood-pressure, deepening the respirations, and warming the gases to body temperature.

DANGERS OF THE ANESTHETIC.

The importance of chemical purity of the anes-

thetic has been brought out by Baskerville. Certainly if pure nitrous oxid is used the danger of over-concentration of the anesthetic is negligible. But in the class of patients we are considering, with serious pathological lesions, myocardial, vascular or renal changes, in which the products of acid metabolism are frequently increased, can any anesthetic be held guiltless of toxicity?

The most conclusive answer to this question should be the mortality-ratio. Unfortunately there is no accurate, analytical compilation of statistics on nitrous oxid-oxygen anesthesia yet available. I speak advisedly, having in mind the importance in all such statistics of a careful analysis of the method employed; of the post anesthetic sequellae; and particularly of a critical scrutiny of the contributing causes to those sequellae in each case. A critical comparison in this way of two parallel series of cases is far more enlightening than a mass-accumulation of inaccurate statistics from different sources, since the accidental omission of a single death or post anesthetic complication entirely alters the significance of the mortality-ratio.

Gwathmey collected in his American statistics 8000 administrations of nitrous oxid and oxygen with no deaths. At the same time, Miller stated the death rate as varying between 1:100,000 and 1:750,000. Teter has reported approximately 10,000 cases with one death, and this not directly attributable to the anesthetic. Gatch, in a shorter series at the Johns Hopkins Hospital, had three deaths all due to contributory causes. Two of these cases were in desperate straits with circulatory changes so severe that the anesthetic could not be blamed. The third case was one of status lymphaticus. In at least one of these, the Trendelenburg position was an additional factor.

It must be evident from these statistics how uncertain the mortality-ratio is, and how much the margin of safety varies with individual cases.

Buckler observes that the most severe cases of post anesthetic vomiting in his experience followed short anesthesias of nitrous oxid-oxygen. He is convinced when all accidental causes can be excluded, such as neurotic temperament, drug idiosyncracy, dilated stomach, etc., that persistent post anesthetic vomiting is invariably due to acid intoxication. In proof of this contention, Buckler has succeeded in greatly lessening the frequency of these disagreeable sequellae by flooding his patients, both before and after anesthesia, with alkalis and carbohydrates.

Crile, in his interesting contributions on anesthesia, has repeatedly urged the importance of preventing acidosis by preliminary dosage with morphin and atropin and the administration of alkalis; and above all has laid stress on the importance of preventing the stimulation of so-called nociceptors through fear, pain and operative trauma. From H-ion concentration tests (of which the details are not mentioned) Crile claims to have found that the acid products of metabolism are increased under nitrous oxid anesthesia, as they are with ether and chloroform. In cases with a tendency to acidosis, he remarks that the increase in acidity produced by the anesthesia may be sufficient to overcome the already narrow margin of safety. Crile is convinced, however, that nitrous oxid is superior to the hydrocarbon anesthetics, because it is not a lipoid solvent, and protects the reserve supply of molecular oxygen in the neurones.

It is possible that both Crile and Buckler have overlooked the most potent cause of acidosis in nitrous oxid anesthesia, a danger inherent in the closed system and due not to the anesthetic but to insufficient supply of oxygen. Oxygen-lack, even in slight degree, means an increase in acid production; and in pathological states the oxidation processes are faulty. In my experience, this is the chief cause of acidosis in nitrous oxid anesthesia, and if oxygen is administered with the anesthetic in sufficient amount to maintain a normal pink color in the capillary circulation, nitrous oxid and even ether in small percentages will not seriously increase the acid products of metabolism.

Personal observations made on two parallel series of 100 cases each, one under nitrous oxid-oxygen-ether anesthesia, the other under straight ether, would seem to offer some support to this contention. Where all other accidental factors could be excluded, such as palpation of the gall-bladder, gastric neuroses, drug idiosyncracy, etc.,—post anesthetic nausea, vomiting and acetonuria occurred in 40 per cent. of the cases with nitrous oxid anesthesia, as contrasted with 55 per cent. where straight ether was used. The point of significance, however, is that there was a direct relation between the frequency and severity of post anesthetic vomiting and acetonuria, and the amount of cyanosis which occurred during the anesthesia. In almost every case where cyanosis occurred to any prolonged extent, nausea, vomiting and acetonuria were sure to follow. In this relation, the duration of cyanosis was a more striking factor than the intensity. Thus transient cyanosis, even though quite marked, frequently was not succeeded by these sequellae, while, on the contrary, low grades of slight duskiness, when prolonged for a measurable period of time, were invariably followed by post anesthetic evidences of acidosis.

THE IDEAL ANESTHETIC.

It has been generally held by neurologists that the synapses of the neurones are the weakest places in the reflex-arc, and consequently are most readily affected by changes in the oxygen and carbon dioxid tensions, and by foreign substances such as toxines, weak acids and drugs. Theoretically, therefore, the ideal anesthetic would have a specific affinity with a minimum or negligible toxicity, for the synapses of the sensory cells of the cerebrum, and would produce unconsciousness and anesthesia by raising the resistance at these junctions and thereby blocking the path of centripetal impulses to the somaesthetic area. Whether or not it is necessary to reenforce this central effect by interposing a peripheral block, as Crile affirms, does not concern us here. Obviously, this ideal anesthetic does not exist, but it has become generally recognized in the majority of large clinics to-day, that nitrous oxid, in expert hands, more nearly meets these requirements than any other anesthetic. It has most of the advantages, and none of the dangers, of the hydrocarbon anesthetics. Thus it is non-irritating, non-lipoid solvent, is only slightly toxic, and does not attack the liver or renal cells. In this latter respect, it should replace chloroform as the anesthetic of choice in obstetrical cases with pernicious vomiting, or signs of eclampsia. The toxines, in pernicious vomiting as Williams has shown, cause a degeneration of the renal epithelium, and a necrosis of the central zone of the liver lobules. Since chloroform, according to Whipple, also produces a central zone necrosis of the liver cells, while ether is irritating to the renal epithelium, nitrous oxid—having neither of these effects—is clearly indicated in all such cases. On the other hand, in eclampsia there is a peripheral zone necrosis, and here again nitrous oxid is preferable to chloroform or ether. Finally, as evidence of the atoxic nature of nitrous oxid when administered with sufficient oxygen, Gatch has reported a case in which the patient was under nitrous oxid for five hours, yet regained consciousness within a few minutes after the mask was removed, and did not even suffer from nausea. And in concluding this evidence, one needs only to recall the classical experiments of Paul Bert, in which animals were kept alive in an atmosphere of nitrous oxid and oxygen for three days, to realize that acidosis under nitrous oxid is negligible if the supply of oxygen is adequate.

ANOXEMIA.

This brings us to a consideration of the third danger of the closed system, namely: anoxemia or oxygen deficiency.

It is this factor of oxygen-lack which I have endeavored to prove should bear the burden of blame and not nitrous oxid per se. Oxygen-starvation means acidosis, and a slight increase in acid-products, as Crile points out, is dangerous in cases with (1) hemoglobinemia, (2) shock, (3) cachexia or starvation, (4) toxemia, (5) cardio-renal changes, (6) pulmonary lesions, and various other conditions of disturbed metabolism in which there is frequently excess of acid products and consequent tendency to acidosis.

Nearly all of these patients may present one or more of the following signs and symptoms:

(1) Color changes such as cyanosis or pallor.

(2) Hemoglobin deficit.

(3) Changes in the respiratory rhythm, as shown by various grades of dyspnea, with or without cyanosis.

(4) Tachycardia, or bradycardia.

(5) Lowered tension of C O_2 in the alveolar air and arterial blood.

(6) Acetonuria, glycosuria, albuminuria.

In nearly all as a rule the hemoglobin reservoirs are low, and the final oxidations of the acid-derivatives of metabolism are incomplete. These acid-products are thus poured into the blood stream in excess and the protective mechanism which we have described is subjected to an abnormal strain. The neutrality of the blood is maintained almost to the end, but with ever-increasing difficulty. Lungs and kidneys are hard pressed to eliminate the acids. Thus in diabetes, for instance, Porges and Fridericia have shown that the carbon dioxid tension is depressed to one-half the normal degree. Porges and his co-workers found, also, that in cardiac disease with dyspnoea there is increased formation of acid bodies as shown by the lowered carbon dioxid tension of the alveolar air, and concludes that acidosis is the cause of this dyspnoea. Lewis and his associates have further concluded that in cardio-renal disease, where dyspnoea occurs without cyanosis, it is due to increased acidity, while in cases of dyspnoea with cyanosis, there is an added factor of oxygen-lack.

These patients with cardio-renal changes are certainly among the most serious risks which the anesthetist meets. The condition is especially precarious because slight degrees of myocarditis or interstitial nephritis often come to the table unrecognized. These patients demand more than the normal volume of oxygen in their tidal air, and slight degrees of asphyxia may fatally increase acidosis or produce a disastrous degree of heart-strain. The Trendelenburg position increases the

liability to this sequel. The injury to the heart muscle may not be evident at the time, since the heart may continue to functionate, but with a greatly lowered reserve power, until it is subjected to some additional strain. This may occur during the period of convalescence, when the decompensation is apt to be sudden and complete.

On the other hand, the most favorable groups among the conditions we have outlined are those with pulmonary lesions, and those in a state of surgical shock due to hemorrhage. It is always surprising for the first time to see how a woman, exsanguinated from a ruptured ectopic pregnancy, will improve under carbon dioxid, provided plenty of oxygen be administered, and the stimulus of carbon dioxid be kept up by rebreathing. The blood-pressure rises; air-hunger is replaced by deepening rhythmical respirations and the waxy pallor gives way to a warm suffused glow.

SUMMARY.

With any anesthetic the so-called margin of safety is a vague hinter-land bordered on one side by the primary stage of analgesia and semi-consciousness, and on the other side by coma, respiratory failure, and death. Beyond the threshold of conscious stimuli, these two extremes blend one with the other as the penumbra and umbra of a shadow. In the closed system with nitrous oxid as the anesthetic, the depth of anesthesia is dependent on the oxygen supply. As the oxygen is diminished the anesthesia is deepened, but the dangers are also directly increased. The best index for regulating the supply of oxygen and preventing anoxemia is the patient's color. In the color of the capillary blood as revealed by the mucus membranes, finger tips and ear-lobes, we have a biological reaction of the greatest nicety. This is far more accurate than any mechanical contrivance for regulating the volume of percentages of the gases, since it has been shown by Lindhard and Hasselbach that the threshold of excitation of the respiratory center, as well as the nature and size of the stimulus, varies from time to time in the same individual. The oxygen-demand is not a constant, but the real constant is the H-ion. The color of the capillary blood indicates with lightning rapidity the degree of dissociation of the oxyhemoglobin and the amount of carbohemoglobin present. Cyanosis means oxygen-lack, and carbon dioxid excess.

Unfortunately, nitrous oxid, by the very mildness of its depressant action, frequently compels the anesthetist to resort to accessory measures in order to produce a satisfactory depth of anesthesia. In this extremity, he should never resort to even minimal grades of asphyxia. It is far better to use such methods as: (1) Preliminary narcosis; (2) Local anesthesia, and (3) the supplemental use of ether in small amounts.

In some cases it may be necessary to combine all three of these measures. A dram or two of ether will usually produce satisfactory anesthesia in these cases, with no harmful effects. A most important factor, as Gatch has shown, is the surgeon himself. He should learn to work in the zone of very light anesthesia.

CONCLUSIONS.

(1) In nitrous oxid anesthesia, the margin of safety is a broad one, and the dangers are seldom due to the anesthetic or to acapnia.

(2) The real danger is oxygen-lack.

(3) This danger is especially great in patients with a tendency to acidosis due to faulty metabolism.

(4) The most reliable control of the oxygen-supply is based on the patient's color. The warning sign is slight duskiness, pallor or cyanosis.

(5) Rebreathing of carbon dioxid in small percentages, up to 8 per cent., is beneficial, particularly in cases of surgical shock.

(6) It is safer to supplement nitrous oxid with other narcotics, or local analgesia than to deepen the anesthesia by decreasing the oxygen supply.

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ANALGESIA, ANESTHESIA AND AMMESIA IN OBSTETRICS.*

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That from the very earliest times there has existed a desire to relieve woman of her suffering when in labor, is made evident by a perusal of the literature. Chronologically analgesia was first employed, later anesthesia, and more recent is the attempt to have amnesia present during labor as much as possible. Of course, the methods overlap in historical sequence, and in some cases two or even all three methods have been the aim.

Before considering the value of various drugs and other therapeutic agents that have been employed to produce these three conditions, I will take the liberty of reminding you that analgesia, or analgia implies relief of pain, or insensibility to pain and may be local or general. Anesthesia is loss of sensation, which may also be local or general. Local anesthesia includes local analgesia. General anesthesia necessarily includes local and

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general analgesia and amnesia. Whereas amnesia, forgetfulness, is inability of the memory to recall events that transpired while the amnesia was maintained.

Labor if normal is physiological, but the suffering has always been considered something to be avoided as far as is commensurate with safety, and the need of this in practice is increasing with each generation. The fetal head is a trifle larger, the female pelvis a trifle smaller, the uterine contractions a trifle weaker and the mother's nervous system much less able to stand the shock of a prolonged labor and all that that means.

During the time of Mesmer, mesmerism, or as we now call it, hypnotism, was not infrequently employed to help women during this troublesome event, and now we still use it in the form of suggestion and encouragement at every delivery.

Chloral and bromides are valuable analgesics when given to women who are worn out and cannot continue to deliver themselves. Under the influence of these drugs the patients fall asleep and awaken somewhat refreshed and able to continue their efforts. During the action of the drugs the uterus no further contracts and the labor is entirely discontinued.

Antipyrine in doses of fifteen to twenty grains per rectum in what is known as the Savitsky method has long been used by a few. It is supposed to allay the pains without appreciable delay of the labor. It is often combined with tincture of opium. It is advised as a first stage procedure, for under its influence the cervix is supposed to soften and more rapidly dilate. These drugs just mentioned are simple analgesics and are only given for temporary relief. Opium and all its derivatives naturally fall into this group, but as they have other uses, I will discuss them later.

Cocain is a drug that also was variously employed in labor. It was used by local application, by local injection, and intraspinously. It is attended with dangers, and delays labor. Locally it was ineffective, and intraspinously its action wore off after an hour and a half to three hours. The technic of these intraspinous injections is not simple and has potential dangers. These methods have been entirely discarded, but more recently cocain and novocain have been tried as parasacral anesthesia, by injection into the nerve roots at their exit from the sacral foramena. These injections are difficult to make and I cannot believe that they will come into general use. Stovain, after being tried in surgery, was also tried in obstetrics. It was believed to be less toxic and its action of longer duration than cocain, but it too has been discarded.

Quinin with urea hydrochlorid by local injection still has a few advocates but it offers little likelihood of becoming generally adopted.

Shortly after the introduction of ether and chloroform these two became very popular in obstetrics, and especially after Simpson, in 1847, applied chloroform in what has since been known as *"sleep á la reine."* Even in those countries where ether became the surgical anesthetic of choice, the obstetricians preferred chloroform. Chloroform has the advantage of quick action, little nausea, comparative pleasantness and ease and simplicity of manipulation. Its chief danger is post-partum hemorrhage. There is also danger of the child being born narcotized. Ether on the other hand, acts more slowly and is more apt to cause nausea and vomiting. It has been proven to be safer in the kidney complications of pregnancy. It causes less post-partum atony and hemorrhage, and after its administration the infant is less apt to be narcotized. Except in obstetrical operations where deep anesthesia is required, these two drugs are dropped on an open mask with the onset of each contraction, and anesthesia obtained with the height of the contraction *"takes the edge off the pain."* This can be repeated indefinitely with each pain until the labor is completed. If the anesthesia is pushed beyond this point the labor will not progress. Except for the undisputed dangers mentioned above the method is safe. But if used for more than the last few minutes of labor it should be administered by a trained expert.

Ethyl chloride has never been recommended in obstetrics except for operations, or where the head has already protruded so far that the obstetrician can deliver it without the aid of further contractions.

Nitrous oxid-oxygen requires the greatest care in administration. In principle it is used just as is ether or chloroform; i.e., as the uterine contraction starts, just enough gas-oxygen is administered to relieve the point of maximum pain. It should be given only by an expert whether used for a short or longer time. Its advantages are its rapid action and the rapidity with which the effects wear off. Its dangers are asphyxia of mother and child, and post-partum uterine relaxation and hemorrhage. The difficulty of application necessitates the presence of a trained anesthetist besides the trained obstetrician, thereby increasing the expense. The large quantities of nitrous oxid needed also add to the cost.

Before the derivatives of opium were so popular an occasional dose of opium or laudanum was given as a temporary analgesic. It was found that,

whereas it often delayed labor, it was not as persistent in this respect as was chloral, and if not given too near the moment of birth, was not only more efficient but likewise harmed neither mother or child. When after an average dose the labor was completed sooner than expected the child was often found to be slightly under the influence of the opium, with slowed pulse and respiration.

When morphin, or narcophin, heroin, or pantopon are used in single doses their effects are similar to those of opium and they act as ordinary analgesics. Morphin, heroin, and narcophin are simple alkaloids of opium; pantopon is a combination of alkaloids, and very efficient.

Quite recently Kapp, of San Jose, California, has advised the use of heroin in labor. He injects grs, 1/12, and repeats as often as the effects of the heroin wear off. He claims that this method is safe for mother and child and relieves the woman of her suffering, keeping her in a continuous state of analgesia and thereby reducing shock.

During the summer of 1914, Prof. Ribemont Dessaignes, of the French Academy of Medicine, announced remarkable effects from the injection of new opium derivative, called Antalgesin. He claimed that it promptly relieved pain with but slight slowing of the contractions and without harm to the infant. It has since been claimed that the preparation is nothing but morphin in solution. I have tried it in several cases and so far am only ready to say that it is a powerful analgesic, that it does delay labor, and that under its influence a certain proportion of babies will be born apnoic, and that I have seen in the mother no symptoms resembling the administration of ordinary morphin, excepting the analgesia.

During the last ten months the most talked-of method for allaying the pains of child-birth has been injections of scopolamin in conjunction with morphin, narcophin or pantopon. In 1902 Steinbuchel suggested the use of the combination of scopolamin and morphin in labor, but he and those who used it after him desired only to obtain analgesia. It was left to Gauss, of Freiburg, to recommend in 1906 the use of this combination in such a manner as to produce amnesia. This he termed *"Dammerschlaf"* (*Twilight Sleep*). The technic, as now perfected and used in over 6000 cases at Freiburg, is as follows:

Before labor starts, the condition of the mother's heart and kidneys must be known, the bony pelvis should have been measured, the fetal heart sounds located and the presenting part of the fetal oval ascertained. After having selected a quiet, dark room, and having excluded from it all but those required at the delivery, everything should be put in readiness for the possibility of a hurried forceps extraction. When labor has advanced to where the cervix is two or three fingers dilated, and the pains recurring every five or six minutes, so as to rule out primary inertia, the patient is ready for the first injection. This first injection will consist of scopolamin grs. 1/150 and morphin grs. ¼. The scopolamin should be either freshly dissolved or prepared according to Straub's instructions. According to the effect obtained from the first injection the obstetrician will wait thirty to fifty minutes, and if all is going well, give the second injection. This and all succeeding injections will be scopolamin grs. 1/450 with nothing else. After the second injection time is not important. The indication for further treatment will depend on the amnesic condition of the mother, and on the strength, rate and regularity of the fetal heart.

The memory test should be applied every ten or fifteen minutes, and the general condition of the mother and the fetal heart should be constantly watched. With the slightest sign of returning consciousness another dose of scopolamin should be given. As the head is being born the pains increase so that the mother, if not sufficiently deep, will here develop an island of memory. If she is not well under at this time a few drops of some general anesthetic should be administered.

As the crying of the baby, like any other untoward noise, or a flash of light is apt to arouse the mother and cause an undesired island of memory, it will be wisest to at once remove the infant to another room. The mother should then be treated like any other parturient woman who has reached the third stage. Such patients are no more likely to bleed than are non-scopolamin patients, but there is this danger: that if hemorrhage does occur the mother may not perceive it, and therefore the watching for this possibility must be extra careful.

If the baby is oligopnoic it may be resuscitated in the usual manner. After regular breathing has once been established these babies should be treated like other babies. The puerperium will certainly not demand any more than the usual care.

This method has the objections that its technic is difficult and that it takes all the time of the obstetrician, much assistance, and surroundings that are often difficult to obtain.

Thus we see that where we wish to give the patient a complete rest and where no harm is awaited from a temporary discontinuance of labor, chloral or bromide with or without some opium preparation is very effective. For prolonged use ether is preferable, unless we can have the advan-

tages of an expert in handling nitrous oxid and oxygen. I feel that in proper hands Twilight Sleep is entirely safe, but its general use is at present quite impossible.

The fact that there is a safe method of allaying pain during parturition would abolish the fear of labor, that in some women becomes an obsession. Such a routine procedure would also have the advantage of preventing the shock of labor that at times causes women to be nervous for years after. According to Crile, if pain and other unpleasant sensations are allowed to travel along the sensory nerves so that they are eventually perceived by the brain-cells, causing hyper and then hypochromatism, and permanent damage of the cells, shock is produced. We must attempt to break this line of connection between the shock-producing agent and the brain-cell at some place where we will do no harm and not interfere with the physiological progress of labor. The blocking agent must not be more dangerous than the shock itself. Sensory depressants fulfill the first condition and the sensory depressants, scopolamin and morphin are reasonably safe, and act as a mild anesthetic, allaying the susceptibility of the brain. By blocking the painful sensations and making the mother oblivious to her surroundings and preventing the chromatic changes which lead to the injury of cells, those drugs tend to lessen shock.

The ideal method or drug I fear has not yet been found, for to be ideal it will have to comply with the following conditions:

1. It must be sufficiently easy of application so that it can be learned by the great mass of physicians practising obstetrics.
2. It must not in its application require too much additional time on the part of the obstetrician.
3. It must markedly reduce the pain and the memory thereof.
4. It must not appreciably delay labor.
5. It must not contra-indicate the use of other drugs which may be required during labor.
6. Its unpleasant effects must be less objectionable than the pain alleviated.
7. It must be safe for the mother.
8. It must not harm the child during labor, at birth or at any future date.
9. It must not cause post-partum atony of the uterus.
10. It must not produce nausea or other subjective disturbances.
11. There must be no deleterious effect on the nursing.
12. There must be no impairment of pueperal involution.
13. Asepsis and antisepsis must not be made more difficult.
14. Shock must be materially lessened.

As stated before no method at present recommended completely fulfills the requirements, but it seems to me that scopolamin and morphin used in strict adherence to the Freiburg technic, until something better is advised, must most often be the method of choice.

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ALKALOIDAL MEDICATION IN RELATION TO ANESTHESIA AND ANALGESIA.*

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The administration of alkaloids before general anesthesia is of special interest to the anesthetist, greater interest than to the surgeon because for the time being the life of the patient is in his keeping. Deaths from anesthetics almost always occur during the operation, while those from operative procedures usually follow the completion of the operation. Simplicity in prescription writing and the administration of fewer drugs characterize the general attitude of the best medical men of the present. We read the prescriptions in the old textbooks and wonder how nature ever combated the action of so many drugs at the same time, and feel that the patient recovered not because of the medication, but in spite of it. Unfortunately today there is a tendency among some surgeons and anesthetists to return to this discarded medication as exhibited in the use of several drugs before, during and after anesthesia. Does not this smack of the old time *shot-gun* prescription, morphin, scopolamin, gas-oxygen-ether-novocain-quinin and urea hydrochlorid?

The advocates of this method glibly point out just what each drug is supposed to accomplish. Did not our forefathers also point out with just as much certainty the particular usefulness of each drug which they incorporated in their mixtures? Granting that this form of anesthesia possesses all the advantages claimed for it, is it to be recommended? It cannot be gainsaid that morphin, scopolamin and atropin alone or some combination thereof associated with general anesthesia have several substantial well defined advantages. The question which naturally presents itself is, what are the disadvantages? Do they balance the advantages or

* Read during the Organization Meeting of the Interstate Association of Anesthetists in Cincinnati, O., May 4-5, 1915.

exceed them? If they do why is this method advocated? Allow me to consider briefly the action of the drugs most commonly employed before anesthesia, namely, morphin, scopolamin and atropin. Morphin and scopolamin are not antagonistic in their action, as is quite generally supposed. Any dose of morphin which produces systemic effects depresses respiration. The depression being characterized by a diminution in the rate, regularity and depth of breathing, scopolamin is not in any dose a respiratory stimulant and in large doses it is actively depressant. Morphin does not directly affect the heart, which continues to beat after respiration ceases. Scopolamin raises blood pressure but usually does not affect the pulse rate. Morphin, scopolamin and atropin all depress kidney function, which is of considerable importance, especially if the kidneys are involved in any pathological process which lessens their working capacity. Chloroform depresses both respiration and circulation. Ether is a stimulant to both respiration and circulation up to a certain degree of saturation and beyond that it becomes a depressant. According to a well-known law in therapeutics the combined action of drugs possessing the same effects is much greater than the sum of their separate action, and this law is especially emphasized in drugs possessing hypnotic properties. Theoretically the danger of combining morphin and scopolamin with chloroform or ether is apparent and practical experience has demonstrated that the danger is real. A smaller dose of ether or chloroform will paralyze the respiratory center if it is already depressed.

The advantages said to accompany the administration of alkaloids before general anesthesia are as follows:

1. Less of the anesthetic is required. Glandular activity is diminished, thereby reducing the danger of pneumonia. There is less vomiting before and during anesthesia, therefore a smoother narcosis and also less post-operative vomiting.

2. The patient's apprehension of impending danger is lessened or altogether abolished and he enters the anesthetizing room in a quiet, sleepy manner. No resistance is made to preliminary preparation.

3. The stage of excitement is less pronounced and muscular relaxation is more quickly developed.

4. The patient remains asleep after completion of operation, hence suffers less pain. Let us analyze these advantages.

(1) *Less of the anesthetic is required*: The lessened amount of the anesthetic required is not so important as is generally supposed. It has been conclusively shown experimentally that the degree of concentration of the vapor is of much greater importance than the length of the administration or the amount used. A very concentrated vapor administered for a few minutes will do more damage to lung and kidney epithelium than a lesser concentration over a long period. In considering the lessened amount of the anesthetic used the action of the substance which replaces it must be taken into account. That the danger from ether or chloroform is diminished has certainly not been proved. On the contrary, a study of the reports of deaths or other bad results clearly shows that the premedication was actually responsible either indirectly by intensifying the action of the anesthetic or directly through its continued action.

(2) *Glandular activity is diminished, thereby reducing the danger of pneumonia*: Many of the postoperative pneumonias have nothing whatever to do with the anesthetic but are embolic in their origin and occur quite as frequently after local analgesia as after a general anesthesia. A pneumonia which develops later than 36 hours after anesthesia should not be considered as due to the local action of the inhaled ether. Since the open method of etherization has become so universally employed, the tendency to postoperative pneumonia and nephritis has been materially lessened.

If the head is turned to the side as soon as the neck-muscles are sufficiently relaxed to allow it, and this can be done early in induction, the salivary secretion will escape at the angle of the mouth or remain in the cheek where it can be sponged out. This position has the further advantage of preventing the tongue from falling back in the pharynx and obstructing respiration. That the aspiration of mucus ever produces pneumonia is a doubtful possibility. If ether actually predisposes to pneumonia it does so by its direct action on the lung epithelium, and it is just as reasonable to presume that the checked secretion would render the unprotected cells more susceptible to irritation.

(3) *Less vomiting before and during anesthesia; therefore a smoother narcosis and also less post-operative vomiting*: There will be no vomiting during the induction of narcosis if the patient has been properly prepared. Vomiting during anes thesia always indicates a light uneven narcosis; in other words, with proper technic an absolutely smooth anesthesia is obtained without preliminary medication.

That postoperative nausea and emesis are lessened is questionable. That vomiting may be delayed is quite understandable from the continued action of the morphin and scopolamin. Patients feel nauseated or begin to vomit several hours after their

return to bed or at a time when they should and probably would be over it if the nausea were due to the anesthetic.

(4) *Apprehension of impending danger*: Nervous patients can usually be quieted by a few cheery words and a little tactfulness in the way of suggesting an improvement or restoration to health. Joking and other forms of hilarity in the anesthetizing room frequently makes the nervous patient fear he is not receiving the close attention which the situation demands. Preparation of the field of operation during induction of narcosis shortens the anesthesia and helps divert the patient's mind from the anesthetic.

(5) *Stage of excitement less pronounced*: When the technic of the induction stage is properly carried out the socalled *stage of excitement* is either absent or so slight as to be scarcely noticeable except in alcoholics. If patients of the latter class are arranged on the table with restraint straps so that they can be controlled, stimulation passes off in a few minutes. The development of muscular relaxation is only a matter of a little more time.

If an opiate is required for the relief of pain it can be administered when the patient is sufficiently awake to complain. Then one can be guided by conditions as to indications and contra-indications for its administration. Following nitrous oxid, it can be given at the completion of the operation while the patient is still on the operating table.

Disadvantages of preliminary medication to general anesthesia may be summarized as follows: (1) Danger of respiratory paralysis; (2) Destruction of pupillary reaction; (3) Varying effects of the drugs; (4) Predisposition to pneumonia in mouth, jaw and throat operations. After-effects as vomiting, headache and a blocking up of secretions. Prolonged respiratory depression which may favor pulmonary edema.

Let us now consider these disadvantages.

(1) *Danger of respiratory paralysis*: In anesthesia the respiratory center is the especially vulnerable point and every hypnotic drug administered increases the danger of respiratory paralysis. Chloroform and ether are so evanescent in their action the patient revives in a comparatively short time when they are discontinued, but when enduring drugs have been administered hours may elapse before the patient is past danger. Furthermore should respiratory failure occur when only ether or chloroform has been given breathing will continue automatically when once re-established by artificial means.

(2) *Destruction of pupillary reaction*: I unhesitatingly place next in importance to respiratory depression the destruction of the pupillary reaction. To one who is capable of interpreting properly this reflex it is of the utmost value. There is nothing else which will denote so absolutely the degree of narcosis, or give more certain warning of approaching danger or indicate it more clearly when it is already present. Eyelid, pharyngeal and corneal reflexes when present simply denote a light anesthesia.* The amount of relaxation in the muscles of the neck and jaw, especially the latter, is of considerable value, but not always reliable.

(3) *Varying Effects of the Drugs*: Because of the varying effects of scopolamin its purity was at first questioned, but it is now well known that equal doses taken from the same specimen affect different people variously, or the same person is variously affected at different times.

(4) *Predisposes to Pneumonia in Operations on Mouth, Jaw and Throat:* In operations on the mouth, jaw and throat an early awakening is most desirable. Morphin allays the reflex excitability of the air-passages, thus retarding coughing and favoring the retention of aspirated blood or vomitus in the trachea and bronchi, a condition which predisposes to pneumonia. Many people are unable to take morphin even in moderate doses without distress and vomiting and in such patients the disagreeable after effects of ether or chloroform would be aggravated.

Well trained, competent anesthetists frequently complain of the surgeon insisting on premedication although they themselves strongly object to it. To my way of thinking this is not playing fair. To handicap an anesthetist is unjust to him and not to the best interest of the patient. Surgeons usually defend their position by saying the patient belongs to them and therefore it is their privilege to prescribe as they see fit. The lack of real knowledge of the administration of anesthetics even among the most competent surgeons is very obvious when one of them attempts the role of anesthetist. The operating surgeon at best can have only a general idea of the patient's condition, while the anesthetist is in a position to follow closely the respiration and circulation throughout, and consequently is, or should be, more competent to judge the value of a procedure than the surgeon. For this reason surgeons who work with regularly qualified anesthetists should consult with them in the selection and administration of the anesthetic, especially in complicated cases. Further, the anesthetist should be allowed the privilege of giving or withholding alkaloids before anesthesia.

* The touching of the cornea is absolutely unpardonable and is as unscientific as it is unclean. Serious eye-infections frequently follow such uncalled-for practices.

Many surgeons give a single hypodermic of morphin before local analgesia, and undoubtedly it is helpful in producing analgesia. However, in checking up the results we found about half of the patients vomited after the operation and for that reason several of the surgeons working in the Presbyterian Hospital have abandoned its use.

Because comparatively few patients die while under the influence of anesthetic agents it does not signify that the proper anesthetic was selected or skillfully administered. The physician who specializes in anesthetics should be as fully alive to the best methods and alert to the advantages and disadvantages of certain procedures as the progressive surgeon or medical man is ready to seize and apply the most improved methods in his work. I do not feel that I am displaying any clairvoyant power when I predict that the time is rapidly approaching when medically qualified anesthetists will be placed in the position that the medical man, the surgeon, the obstetrician, the pediatrist, the pathologist, the bacteriologist now occupy. When the administration of anesthetics becomes a respectable part of medicine it will not be controlled by the operator and relegated to the least competent person to administer.

CONCLUSIONS.

1. That the administration of morphin, scopolamin and atropin before general anesthesia has certain advantages, but these advantages are not sufficient to counterbalance the risks attendant on their employment.

2. That a smaller amount of ether or chloroform will cause respiratory failure if the center is already depressed by hypnotic drugs.

3. That the loss of the pupillary reflex is a serious handicap, as nothing else indicates so unerringly the degree of narcosis.

4. That the danger from ether, chloroform or nitrous oxid is diminished is contrary to the evidence at hand.

5. That they should not be employed when untrained, inexperienced anesthetists are in charge, as the anesthetic is rendered more complicated and extra skill and judgment are required

110 S. ASHLAND BLVD.

DISCUSSION.

DR. MOSES SALZER, Cincinnati, O.: To discuss this very interesting paper intelligently, we must consider the various anesthetics involved separately. The physiological actions of chloroform, ether and nitrous-oxid are so fundamentally different, that it does not follow that because the preliminary use of narcotics may be harmful with one of these that it is harmful when used as a preliminary to the other two.

Chloroform, we all know, is a marked respiratory depressant. At the same time it is exceedingly powerful in its action, or toxic, and is *very* slowly eliminated. The use of any narcotic preceding chloroform is not only dangerous but unnecessary, as a smooth agreeable anesthesia is always possible without its use.

In ether, however, we have an agent which is much less toxic than is chloroform, which is more quickly eliminated and whose action on the respiratory center is less marked and less likely to manifest itself suddenly. I agree with the essayist that the *routine* use of morphin, or any other narcotic, before an ether anesthesia is to be condemned. It should never be used in the very young, or the very old or in those in very poor physical condition, not only because of its possible danger, but because its use is unnecessary. When, however, adults who are in splendid physical condition are to be anesthetised, there can be no question that there is a distinct advantage in the use of a preliminary narcotic. I do not believe that in *experienced* hands the dangers are increased in this class of cases and there is no reason why we, as specialists in anesthesia, should hesitate to use morphin as a preliminary to an ether anesthesia, because it is not safe for a novice to do so. One may as well argue that because an appendectomy is a dangerous procedure in the hands of a novice, that it had better never be performed.

The physiological action of nitrous-oxid oxygen is so entirely different from ether and chloroform, that I am almost tempted to ask, is it safe not to use morphin as a preliminary to this type of anesthesia. No toxic effects of nitrous oxid, per se, are to be feared. The question of its elimination is not to be reckoned with, as this occurs all too quickly. It has no depressing action on the respiratory center. The respiratory center is more likely to be *dangerously* over-stimulated on account of the increased accumulation of carbon dioxid which can not be entirely prevented in the average case brought to surgical anesthesia. There is a tendency for the development of a dangerous irregularity of the breathing. The preliminary use of morphin not only largely prevents this, but makes for a smoother and *safer* anesthesia. Those cases in which opium or some of its derivatives can not be given as a preliminary to nitrous oxid anesthesia, are always sources of great concern to me. One of the reasons that I do not ordinarily give nitrous oxid to children, is because I can not give them morphin. I am, of course, in this whole discussion considering anesthesia for major surgical work. My narrowest escapes from fatalities were in those cases in which I had not used a preliminary narcotic. The patient wakes up all too quickly following a nitrous oxid anesthesia, even with the preliminary injection of morphin, and to deny them this would be the heighth of cruelty.

The claim therefore that the respiratory center is dangerously depressed and that elimination is seriously interfered with, when a preliminary narcotic is given, holds good for chloroform and, under certain conditions, for ether, but never for nitrous-oxid oxygen anesthesia.

I wish to say a word here also regarding the use of codein and heroin instead of morphin. I have used both of these drugs with very satisfactory results, especially the former, in grave genito-urinary cases, and in cases where there seems to be a special idiosyncracy to morphin. A dose of one grain of codein and 1/12 grain of heroin will correspond to about ¼ grain of morphin. These drugs are less likely to be followed by nausea than is morphin.

ANESTHESIA FOR BRAIN SURGERY.*

CHARLES K. TETER, D.D.S.
CLEVELAND, OHIO.

The accomplishment of successful brain surgery requires greater skill and the exercise of keener surgical judgment on the part of the operating surgeon than does any other field of surgery. Extensive brain surgery is of comparative recent development and has largely resulted from the work done by Cushing, of Boston, Frazier, of Philadelphia and Rawlings and Horsley, of London.

The profession is greatly indebted to these men for the vast amount of literature which they have written on brain surgery, and for reporting their technics and methods in detail. Very little, however, has been reported regarding anesthesia in brain surgery.

The brain surgeons do not agree as to which is the best anesthetic agent for this purpose, but do agree, however, that the anesthetist should be one especially expert in administering anesthetics, inasmuch as the giving of the anesthetic is far more important than the selection of any special anesthetic agent. It is becoming more generally understood, that the safety of any anesthetic agent depends upon the expertness of the administrator. An

* Read during the Organization Meeting of the Interstate Association of Anesthetists, in Cincinnati, May 4-5, 1915.

expert anesthetist does not confine himself to any one agent or method of anesthesia, for he knows from experience that the modification of any method is necessary at times.

The human organism is such that there is no agent at our command which we can administer that will always act the same or produce the same results.

The skilled anesthetist will be able to use the proper agent and proper method as the exigencies of the case may demand. All anesthetists are not skilled, however, in administer all of the different anesthetic agents, and are, therefore, not familiar with the special technic required with the different agents, nor the physiological action produced by each.

It will not be my aim to enter into the discussion of all methods of anesthesia in brain surgery, but will confine this paper to the best methods of administering ether and nitrous oxid and oxygen.

Chloroform was formerly preferred and used in brain surgery, but in America, ether has practically supplanted chloroform, while in Europe chloroform still is the preferred anesthetic agent for this purpose. Nitrous oxid and oxygen has not as yet had a thorough trial as the anesthetic in this special line of work. However, if it is skillfully administered and properly supplemented with morphin and ether when necessary, it has by far the greater possibilities.

When cases requiring brain surgery are presented for operation, they are usually in a semi-conscious comatose or dulled mental condition, and, therefore, need a comparatively light general anesthesia.

Again, too, the nature of the tissues are such that after the scalp has been cut through there is very little pain produced by the operative trauma. We do not meet with the rigidity in these cases that we sometimes encounter in abdominal surgery under nitrous oxid and oxygen, so it is possible to induce and maintain a quiet anesthesia with nitrous oxid and oxygen in brain surgery, and at the same time, eliminate all interference with normal oxidation, thereby maintaining an even blood pressure, good respiration and an excellent pulse.

There are certain requisites that should be observed in administering anesthetics for these operations regardless of the agent used. Viz: The anesthetist or his appliance should not be so located as to interfere with the operating surgeon or his assistants. The inhaler or mask should be so adjusted that it may be completely isolated from the field of operation and offer no chance of infection from this source. All appliance around the face should be completely covered with sterile towels and sheet. I do not favor covering the anesthetist with a sheet as is practiced in some clinics for the reason that the anesthetist must have full knowledge of the progress of the operation that he may intelligently perform his part.

The continuous drop method of ether has no place in this line of surgery, as it is not possible to carry out the above requisites, unless Criles' nasal tubes and funnel are used.

Fig. 1. Author's positive pressure pharyngeal inhaler for nitrous oxid-oxygen anesthesia.

This appliance consists of two rubber tubes, a "Y" connection, a glass trap and an ordinary funnel. The patient is anesthetised in the usual way by face mask and drop method of ether, and carried to complete anesthesia. The nares and throat are swabbed with 2 per cent. cocain solution, after which the tubes are inserted. Two rectal tubes are selected that will completely fill the nares, and these are passed into the posterior pharynx as far as the epiglotis. The tongue is pulled forward and damp gauze is packed at the base of the tongue completely filling the back part of the mouth, thus forcing the patient to breathe through the tubes. The funnel is filled with loose gauze and a layer of stocking net stretched over the large end. Ether is continually dropped into the funnel and anesthesia thus continued as desired. The glass trap serves as a catch for excess ether if used, and also

for the mucus as it may be thrown off during exhalation.

The disadvantages of this method are; (1) The length of time consumed from the commencement of induction of anesthesia until the special appliance is in position. (2) the frequency with which obstructions in the nose, such as spurs or deflected septum, are encountered.

The Gwathmey warm vapor method of ether with Lumbard's small nasal tubes may be used to great advantage and success. This method consists of induction with the ordinary face mask and drop ether or may be modified by having a small perforated tube surrounding the base of the mask through which ether vapor is forced.

When surgical anesthesia is established, the mask is removed and two small rubber tubes are inserted into the nares, passing them into the pharynx. A continuous stream of warm ether vapor is forced through these tubes, from either a foot or hand bellows forcing air over or through the ether contained in the bottle. The patient may breathe either through the nose or mouth with equally good results because the nasal tubes should be of such size as to not offer any great obstruction to the egress of the exhalations through the nose. A tube may be passed through the mouth into the throat and the vapor delivered in this manner, but as good results will not be obtained as by the use of the small nasal tubes.

The administration of nitrous oxid and oxygen in brain surgery may be used with the maximum efficiency as we have now developed perfection of delivery and accuracy of dosage with these gases. The only objections to nitrous oxid and oxygen in these cases heretofore were the increased congestion of the brain and accompanying increased blood pressure, also the interference of the face mask with the surgeon. These objections no longer exist.

In 1906 I administered nitrous oxid and oxygen for brain surgery for the first time. In 1907 I reported a number of cases.* It was proven at that time that the dilitation and the congestion of the brain were not due *per se* to the effect of the nitrous oxid but was an entirely asphyxial manifestation.

By the perfecting of the technic, a nitrous oxid and oxygen anesthesia may now be given with certainty, which will be void of all asphyxial symptoms in 90 per cent. of brain surgical cases. The ten per cent. may be successfully and safely anesthetised by supplementing the nitrous oxid and oxygen with a small amount of warm ether vapor.

I perfected a positive pressure pharyngeal inhaler two years ago, which embraces the following features. It delivers the gases into the pharynx under any desired pressure; it assures an unobstructed respiration; it is self-retaining and all may be completely covered over and isolated in head or neck surgery.

This inhaler consists of a curved, flat, metal tube which extends to the epiglotis and conforms to the base of the tongue. There are four openings at the end of this tube. These are so arranged there can be no obstruction of the tube. At the outer end of the tube are lead serrations for the teeth. There is a rubber pad stretched over these lead serrations, so shaped that it rests between the gums, teeth, cheeks and lips. On the outside of this is a wide rubber band, which is tied around the head or neck, thereby, retaining the inhaler in place.

Generally a sedative consisting of one-sixth grain of morphia or one-sixth grain of pantopon, is given one-half hour before the operation.

Anesthesia is induced by means of the small nasal inhaler. Profound anesthesia should be secured in about three or four minutes at which time the mouth is opened and the pharyngeal inhaler placed in position. While this inhaler is being adjusted, the nasal inhaler is left in place and the gases allowed to flow through both inhalers until the adjustment is completed, at which time all the gases are allowed to flow through the pharyngeal inhaler. The nasal inhaler is then removed, and a clamp put on the nose. All of this change may be accomplished in much less time than it takes to describe the method.

This is my method of procedure, not only in head, neck and brain surgery, but also in all cases of prolonged operative surgery. It is now possible to give all patients the advantages of a nitrous oxid and oxygen anesthesia regardless of the nature of the operation. This fact will make it possible to operate upon many critical cases which heretofore could not have hoped for surgical intervention.

Since the knowledge of an anesthetist should include more than simply administering the anesthetic, I will conclude with a few words in regard to precautions to be taken against shock in brain surgery:

(1) Increased blood pressure is to be avoided in this line of work. The anesthetist should, therefore, be informed in regard to the blood pressure by an assistant assigned for this purpose. Increased blood pressure may result from obstruction to respiration, improper proportion of the gases or other faulty technic. If sufficient depth of anes-

* Paper read before the Thirtieth Annual Meeting of the Pennsylvania State Dental Association, July 9, 1907.

thesia cannot be obtained with nitrous oxid and oxygen without intercurrent asphyxia, it is much safer to supplement the gases with a small amount of ether and oxygen given in sufficient quantities, to eliminate all interference with normal oxidation.

(2) Loss of blood should be prevented as far as possible. In severe cases of hemorrhage, it may be advisable to bandage the limbs from below upward, because in so doing, the supply of blood to the vital centers will be increased.

(3) The head and shoulders of the patient if raised upon pillows or sand bags will have a tendency to lessen the shock.

(4) The patient should be kept warm and the body heat preserved. The administering of the warm anesthetic vapors greatly facilitates this feature.

The success of any anesthetic depends greatly upon the skill with which it is administered. Many of the deleterious post operative effects of ether may be eliminated, when it is administered scientifically, and the same may also be said of all other agents. Each has its place. It is the trained anesthetist who recognizes the merits of all and respects the same.

I would, therefore, urge upon every anesthetist to perfect his technic and thus aim for a higher standard so that the surgeon, having experienced the pleasure of operating upon patients scientifically anesthetized with the proper agent, will demand the best anesthetist available.

ROSE BUILDING.

DISCUSSION.

DR. W. I. JONES, Columbus, O.: It is my opinion that the very same reasons that are advanced for the superiority of nitrous oxid oxygen over chloroform, ether, ethyl chloride and other anesthetics are sufficient ones to make it the anesthetic par excellence in brain surgery. The one main objection that some operators have to gas-oxygen anesthesia, namely, lack of relaxation, is here no objection whatsoever because it is possible to have unconsciousness to pain without complete relaxation, and as complete relaxation is no longer considered the essential element in modern surgery, it would seem to me that nitrous oxid oxygen is the anesthetic of choice.

The fear that some operators have expressed of apoplexy resulting from nitrous oxid oxygen anesthesia is without foundation. I am convinced of this from my own experience in administering gas-oxygen for brain surgery, and in a number of experimentations performed upon dogs by Dr. McPeek and myself in the Physiological Laboratory of the Ohio State University Medical Department.

We found that it is possible to have deep surgical anesthesia before there is any turgescence of the vessels of the brain and that a rupture of a blood vessel in the brain is highly improbable, because to produce it you must go far beyond surgical anesthesia. In our experiments, even when we had purposely produced the death of the animal by asphyxiation and there was present great cyanosis and turgescence, there was no evidence of ruptured blood vessels. I cite these examples not to invite carelessness upon the part of the anesthetist and lead him to disregard the danger signs, but to prove that the danger of apoplexy is very remote.

FEATURES IN THE JANUARY SUPPLEMENT

MAGNESIUM SULPHATE ANALGESIA,
D. D. DENEEN, M.D., F.A.C.S.,
Cincinnati, Ohio

BLOOD-PRESSURE UNDER ANESTHESIA
E. I. MCKESSON, M.D.,
Toledo, O.

INTRATRACHEAL INSUFFLATION.*

BENJAMIN MERRILL RICKETTS, M.D., F.A.C.S.,
CINCINNATI, O.

As early as the middle of the sixteenth century Vesalius I. recognized the possibility of aerating the blood, after the chest had been opened, by passing a continuous current of air through the lungs.

Vesalius, 1514-1564, a Dutch physician, journeyed from Luvain, now in Belgium, to Venice by way of Perpignan to Cyprus, with Malatesta, then commander of the Venetian forces on the Island.

Fig. 1. 1514—Vesalius—1564.

Thence to Jerusalem on a pilgrimage to the Holy Land.

He was requested to open the thorax of a man supposed to be dead. The heart began to beat, but he soon died. Vesalius was prosecuted for murder. The King of Spain saved him and he continued on his journey to the Holy Land, from where he started on his return to Padua to occupy the chair vacated by Fallopius, who had recently died. Fallopius had been his bitter enemy.

A storm raged on the Indian Sea, during which his ship was wrecked. He took refuge on the

*Read during the Organization Meeting of the Interstate Association of Anesthetists, Cincinnati, May 4, 1915.

Island of Zakinthos, where he was found fifteen days after, exhausted from starvation, which caused his death a few days later.

Although very young when he died, he had become the most famous of anatomists, having produced more and added more to anatomical knowledge than all of his predecessors.

In 1667 Hook read before the Royal Society a paper entitled, "An Account of an Experiment Made by Mr. Hook by Preserving Animals Alive by Blowing Through Their Lungs with Bellows."

In his experiment, Hook, having laid open the entire thorax of a dog and removed the pericardium, sustained the animal's life, first by reciprocal inflation and deflation of the lungs, in imitation of normal respiration, and then by means of a constant current of fresh air under such pressure that all respiratory movements of the lungs themselves were suspended. Both methods were successful in continuing animation and the pulmonary circulation.

While mechanical respiration remained a valuable adjunct of laboratory experiment for almost 250 years, its failure as a human resuscitative measure in the practice of such surgeons as LeRoy of France, and John Hunter, Monroe and Dalrymple of England, forced the scientist, John Erichson, in 1845 to conclude that, *"In spite of all the improvement and modifications of the technique and the methods of inflation by bellows, mechanical respiration never again came into favor and was speedily forgotten when the postural methods came into use."*

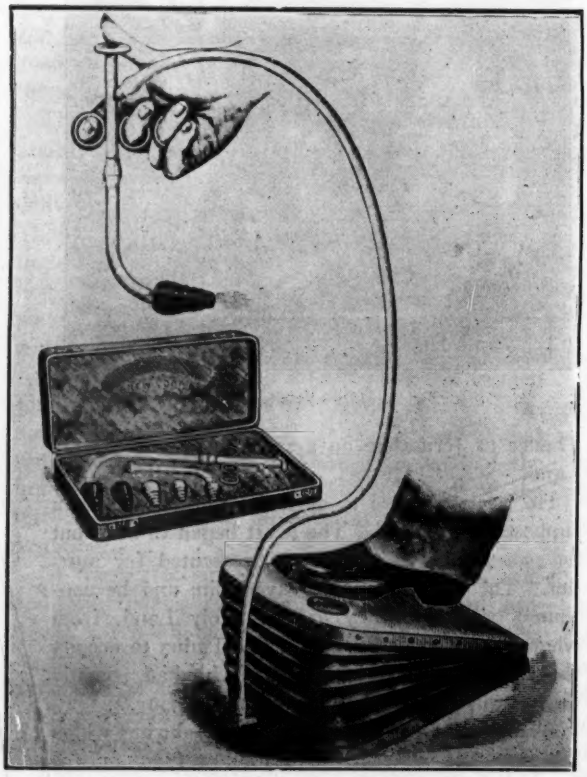

Fig. 2. The original Fell-O'Dwyer Apparatus as used in the Presbyterian Hospital of New York.

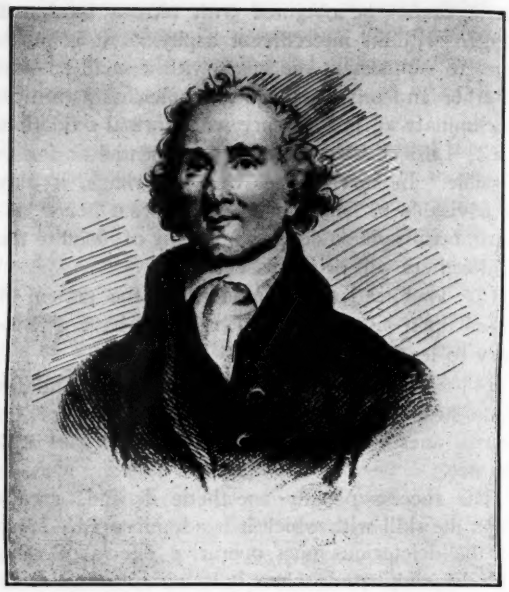

Fig. 3. 1728—John Hunter—1793.

Marshall Hall was especially severe in his condemnation of forced mechanical respiration by means of bellows, and until 1887 the postural resuscitative methods of Hall, Sylvester, Schäfer, and Howard were extensively employed.

On July 23, 1887, Dr. George Edward Fell of Buffalo, N. Y., after all the postural methods of resuscitation had been tried and failed, by means of forced respiration saved the life of a patient who had taken twenty grains of morphine and some chloral hydrate, even after the pupils had dilated in the last stage of asphyxia. Within about three months following, Prof. Dr. Boehm of the Allgemeines Krankenhaus in Vienna saved the life of Dr. Langer by the same method.

Other successful cases of a similar character followed, and established a new epoch of artificial respiration. In practice Dr. Fell used an especially devised face mask and a trachectomy tube, and later an intubation tube, the invention of Dr. O'Dwyer, connected to a single bellows and provided with a coronet piston exit valve, by the manipulation of which inflation and deflation of the lungs could be made to duplicate normal breath-

Fig. 4. George Edward Fell, M.D., the outstanding pioneer of intratracheal insufflation.

ing. In one instance, the case of Dr. Williams, reciprocal respiration was continued intermittently during four days, with recovery of the patient, and without any untoward pulmonary laryngeal or systemic complications.

It was through the incentive given to artificial respiration by the introduction of Fell's method of "forced respiration," and the adaptation of etherization to the technic, that the surgery of the thorax, through its utilization became a possibility. F. W. Parham of New Orleans was the first to successfully remove a sarcomatous growth from the walls of the thorax, using "forced respiration anesthesia" by the Fell-O'Dwyer method, for purposes of the narcosis and combating pneumothorax. The operation was performed under reciprocal breathing, and the chest walls were closed with the lungs fully inflated. Complete recovery of the patient ensued.

About 1896 the French surgeon, Tuffier, in association with Hallion, after exhaustive inthrathoracic experimentation under continuous insufflation, concluded that, "the success of this method on animals justified its use in man." In 1902 Matas turned his attention to a solution of the surgical problems involved in pneumothorax.

Kuhn of Cassel, who had made intubation a specialty since 1895, in 1905 came out with a positive differential method for compensating pneumothorax, based on insufflation by intubation. He at first closed the mouth tight, but in 1908 improved his previous technic by introducing two tubes in one, a narrow tube for inbound compressed air and a wider one for the exhaust. After many experiments on the human being, Kuhn found it advisable to keep the tube out of the trachea, and to stop it just below the larynx. While Kuhn demonstrated the pulmonary application of anesthesia by intubation to Czerny of Heidelberg, Trendelenburg of Leipsic, Angerer of Munich, and Lotsch of Berlin, visiting each of these surgeons personally, nevertheless the method was not favorably received for use in intrathoracic surgery on the human subject.

In 1908 Robinson of Boston intubated through the mouth to the bifurcation of the trachea, sending in air under pressure through a cannula, and lettting the exhaust escape by way of the remaining lumen of the trachea. Later Robinson investigated the Volhard-Sollman method of oxygen insufflation, by means of which, during animal experimentation, life could be sustained without distention of the lungs; but he was distracted from perfecting this or the air-insufflation technic by becoming interested in progressive improvements

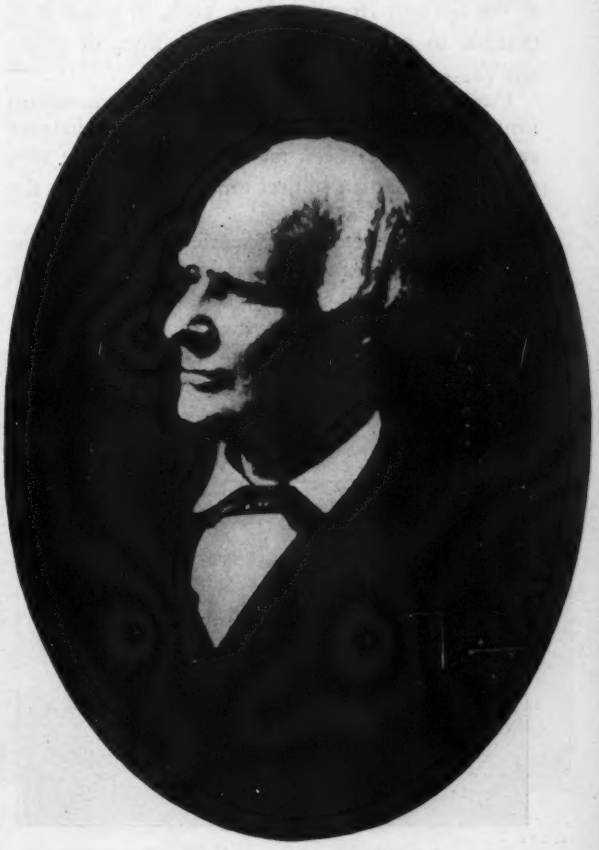

Fig. 5. 1805—Dr. Robert Peter—1894.

which he made in both the Brauer and Sauerbruch methods.

Mikulicz, however, must be credited with the first systematic investigation of the physiological problems besetting intrathoracic surgery. At his suggestion in 1903 Sauerbruch began a series of experimental researches, and in 1904 completed cabinets for intrathoracic surgery, using respectively positive or negative pressure.

While Sauerbruch soon discarded his hyperatmospheric apparatus in favor of his negative-pressure cabinet, Brauer, working independently, developed the first positive-pressure chamber to come into general use. The apparatus devised by Karewski resembled closely that of Brauer, as did also the initial cabinets of Janeway and Green. The devices of Tiegel and Brat-Schmieden were essentially of the emergency or laboratory type, although an effort was made to adapt them to the more exacting requirements of intrathoracic surgery on the human subject.

What Carrel has termed the *classical type* (cabinet) of apparatus has found its apotheosis in the new intrathoracic surgical pavilion of Willy Meyer at the German Hospital, New York, in which it is possible to operate differential, positive, or negative pressure at will.

Until the present popularization of intratracheal insufflation by the Meltzer-Auer technic, whatever real progress has been made in intrathoracic surgery on the human subject must be credited to the *classical type* of apparatus.

In 1908 Meltzer saw Sauerbruch doing intrathoracic surgery, and later witnessed some of Willy Meyer's operations at the Rockefeller Institute, and seeing both pleural cavities wide open and the animals continuing to breathe, but not trusting the evidence of his own eyes, he went into his laboratory to verify the experiments. A year later, in association with Dr. Auer, he published an article

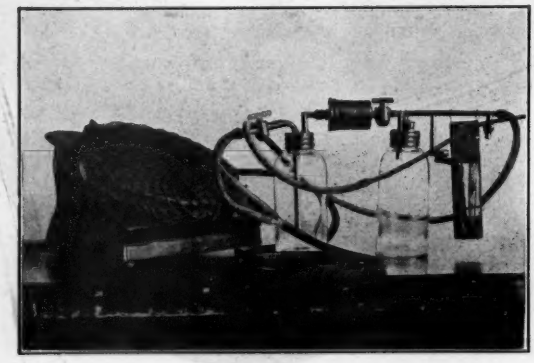

Fig. 6. A modern type of intratracheal insufflation apparatus.

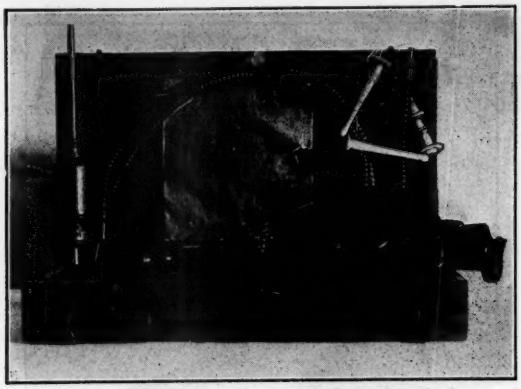

Fig. 7. An old type of intratracheal insufflation apparatus, (1750) purchased by Dr. Peter in Paris in 1836, and presented by his daughter to Dr. A. H. Barkley of Lexington, Ky.

on "Continuous Respiration without Respiratory Movements." After Meltzer had perfected the technic of intratracheal insufflation in his laboratory, Elsberg, with the assistance of Yankauer, developed an apparatus for its use on the human subject, and personally administered anesthesia by this method for a successful thoracotomy performed by Dr. Lilienthal at Mt. Sinai Hospital in 1910.

Meanwhile, Morriston Davies, after a thorough investigation of all the intrathoracic apparatus and methods in vogue, perfected and used a hyperatmospheric device, combining both the advantages of the cabinet and intratracheal insufflation technics, and to Elsberg, and Peck (New York) and Davies (London) belong the credit, not only of adapting intratracheal insufflation to the requirements of intrathoracic surgery, but also of demonstrating its value as a technic of narcosis in the surgery of the head and neck.

While the *classical type* of the cabinet and intratracheal style of apparatus are in apparent competition for supremacy, still each has its possibilities and its limitations, and further clinical experience alone will determine their respective utility in certain definite intrathoracic surgical procedures.

Physiological Considerations.—Progress in intrathoracic surgery has depended absolutely on the mechanical control of pneumothorax during the operative procedure. This mechanical control has varied in different methods, from that of Hook, now represented by the Meltzer-Auer technic, in which the lungs for certain periods have been so distended by a constant current of air as to preclude more or less any respiratory movements, to that of Volhard-Sollman, in which the lungs have been allowed to collapse, while a current of oxygen sustained life.

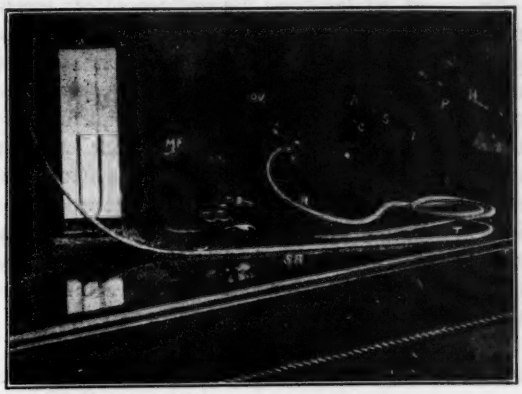

Fig. 8. Original model of the Matas intratracheal insufflation apparatus.

However, for all practical purposes, reciprocal breathing, under manometrically controlled positive, negative, or differential pressure, has proven the only safe method of compensating pneumothorax during intrathoracic operations upon the human subject.

Any consideration of pneumothorax involves an understanding of some elementary facts of the respiratory mechanism. Respiration is made possible in the thorax of the human subjects by a partial vacuum existing in the pleural space after the contraction of the lungs during expiration. This vacuum is represented by a varying negative pressure of from 4 to 10 mm. of mercury. Consequently thoracotomy requires either positive-pressure insufflation, with or without respiratory movements, or autorespiration in the negative or differential pressure cabinet, to prevent the collapse of the lung resulting in dyspnea, displacement of the thoracic viscera, shock, and death.

With the body of the patient within the cabinet in which the air has been rarefied to approximately the negative pressure in the pleural cavity (4 to 10 mm.) and the head of the patient is outside the chamber, permitting the respiring of normal pressure atmosphere, Sauerbruch, by varying the negative pressure as required, has been able to conduct intrathoracic operations with almost the same confidence as in abdominal surgery. In the Meyer cabinet differential pressure allows the surgeon to use positive, negative, or combinations of both pressures as needed. The great distinction between the cabinet control of the pneumothorax and intratracheal insufflation is that in the former autorespiration is depended on to conserve life, and already overtaxed and weakened nerve centers are called upon to formulate respiratory impulses, while during intratracheal insufflation these centers can be made to remain passive, thereby adding a determining factor between success and failure. Moreover, in some operative procedures those muscles which participate in respiration are rendered inactive, thereby making the use of intratracheal insufflation all the more imperative. This demand is accentuated whenever during the course of any intrathoracic procedure dislocation of the posterior lobes of the lungs inhibits the usual respiratory movements.

Respiratory movements are not only concerned in the aeration of the lungs, but also contribute a factor essential to the normal maintenance of the pulmonary circulation and of considerable importance to that of the systemic. Thus the pulmonary circulation may be regarded as of double function, the ventricular, impelling the blood onward with rapid pulsations of the cardiac rhythm, while the lungs contribute the slower but more voluminous impulses of the respiratory cycle. (Davies.)

Hence it is that during intracheal insufflation Meltzer has found it inadvisable to use a pressure which altogether suspends respiratory movements, resulting in apnea and CO_2 asphyxia, and suggests that, in so far as it is possible or necessary, the lungs be periodically deflated five or six times to secure not only a more satisfactory diffusion of the air and anesthetic in the smaller bronchi and alveoli, but also to eliminate CO_2 accumulation, and further to preserve the stimulus of respiratory movements upon the pulmonary and systemic circulations. In cases of open pneumothorax in which the respiratory mechanism is not paralyzed, spontaneous respirations offer the required aid to continuous intratracheal insufflation.

However, it is always advisable to arrange for

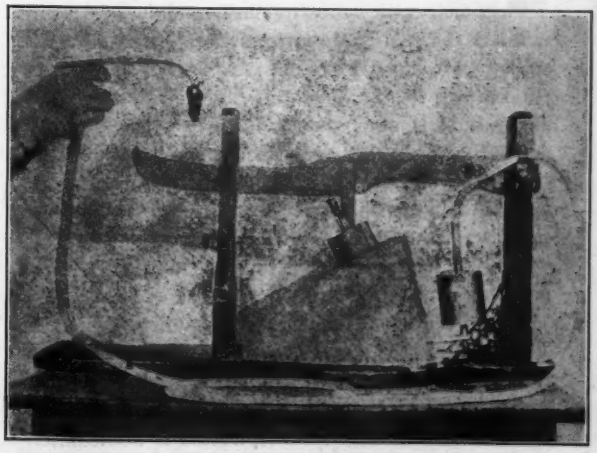

Fig. 9. Dr. J. D. Bloom's modification of the Fell-O'Dwyer apparatus as used by Dr. Parham in the Charity Hospital of New Orleans.

occasional interruptions of the continuous insufflation, especially in operations in which the thorax has to be laid wide open and the posterior and inferior portions of the lungs have to be dislocated, in which condition spontaneous respirations are of no avail. The occasional deflation of the lungs insures the continuance and efficiency of the pulmonary ventilation under all circumstances. It is essential, however, that this deflation be not allowed to result in a complete collapse of the lung, for reinflation under the circumstances may leave portions of the lung atelectatio.

Moreover, such deflation is valuable as a diagnostic factor in differentiating healthy from pathological lung tissue by the change of color and the presence or absence of proper distention. Again partial deflation is useful in left-sided pneumothorax, particularly in suturing the wounds of the heart, under which circumstances hemorrhage from the heart wound, according to Friedrich, diminishes in proportion as the lungs are allowed to collapse.

The partial pneumothorax thus becomes the regulator of the hemorrhage and is allowed to persist until suture of the heart wound has been completed, after which the pericardium and pleura are closed with the lungs properly reinflated.

Extensive laboratory experiments, which have been verified by post-operative results in the human subject, prove conclusively that so far as respiratory complications are concerned intratracheal insufflation is an innocuous procedure even in the presence of the lobar pneumonia. Also it has been found in practice that the recurrent air-stream through the trachea precludes the possibility of aspirating vomited material or hemorrhage from the pharynx.

Physiologically, the intrinsic value of intratracheal insufflation is exemplified not only in the original work of Fell, but also in the laboratory experiments of Shaklee and Githens on the treatment of strychnine poisoning, in which, although the very centers of respiration were paralyzed, intratracheal insufflation reached the climax of its usefulness as a measure of resuscitation and the conservation of life.

Meltzer has also found that anesthesia by intratracheal insufflation is far superior in many respects to the usual methods of administering ether. The anesthesia is much safer, far more readily controlled; less of the anesthetic agent is used, patients go under and come out more rapidly, and an efficient method of artificial respiration is immediately at hand to take care of untoward complications.

In recent studies on the influence of intratracheal insufflation on blood pressure and respiration, Meltzer and Githens found that a manometric pressure of from 30 to 40 mm. and a percentage of ether just sufficient to complete anesthesia, from 50 to 75 per cent. were innocuous, but that an increase of pressure and the percentage of ether for any appreciable length of time would result in an undulating fall of blood pressure, a slowly and diminished excursion of respiratory movements, with final cessation of breathing, although the heart continued to beat.

Resuscitation was possible in animals within 20 minutes by the insufflation of pure air. From the

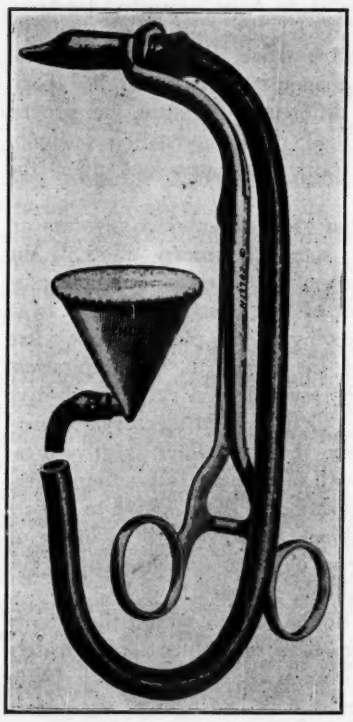

Fig. 10. Doyen's intra-laryngeal tube and cannula for chloroform anesthesia.
Fig. 11. The Original Fell apparatus for artificial respiration.

experiments it appeared that an overdose of ether first paralyzed the functions of the medulla and then much later the functions of the heart. Hence the caution in administering intratracheal insufflation to reduce the ether percentage in ratio to the shallowness and diminished rate of respiration.

Untoward respiratory and associated cardiac complications may also result from operative manipulation of the vagi and their branches, and the resulting false apnea may be controlled by the hypodermic use of atropin.

An increase of pressure, accomplished either by

means of the air current or indirectly by momentary pressure on the larynx, is valuable not only in gauging the proper distention of the lung, but also in obviating cyanosis and in overcoming the resistance of neurotic individuals to the anesthetic effects of the ether. All investigators have found it expedient to add a tank of oxygen to their armamentarium for intratracheal insufflation. Under certain circumstances a persistent cyanosis will develop, which nothing short of oxygenation will control.

While Brauer uses the Roth-Drager, and Davies

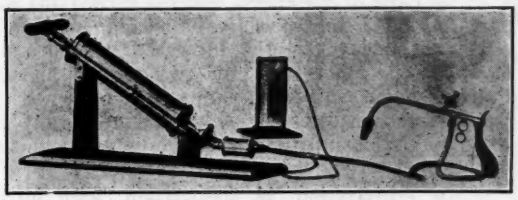

Fig. 12. Later working model of the Matas apparatus.

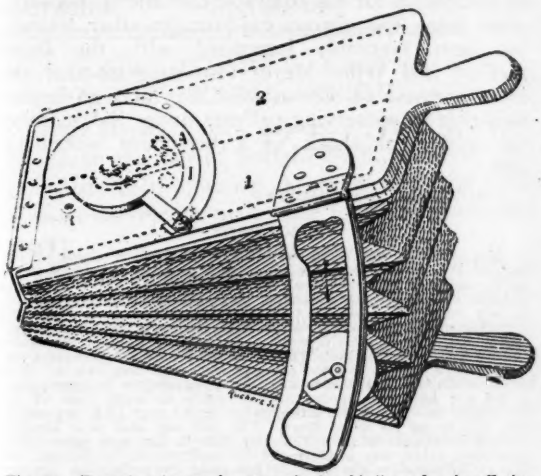

Fig. 13. Doyen's compound automatic hand-bellows for insufflation respiration.

the Alcock regulating chloroform apparatus in conjunction with mechanical respiration for purposes of pulmonary anesthesia, ether seems to be a far safer agent for routine narcosis by this method.

As early as 1827 Portal produced an artificial pneumothorax without thoracotomy by the injection of sulphuretted hydrogen gas into the thoracic cavity to place the lung at rest when affected with tuberculosis. Holmgren pursued the same principle of treatment for unilateral pulmonary tuberculosis even in cases in which adhesions between the visceral and parietal pleuræ contraindicated its use. Hamman of Johns Hopkins is now utilizing a similar technic with nitrogen gas. In the presence of adhesions the preliminary injection of saline solution to collapse the lung is advisable before injecting the gas to produce the therapeutic pneumothorax.

Perforation of the thoracic wall does not always result in pneumothorax, unless the opening is larger in diameter than that of the glottis, or is valve-like in character as in oblique puncture of wounds. As a rule, pneumothorax will disappear when the opening in the chest wall has been closed by the adjacent integumentary structures. These two facts have enabled surgeons, by means of tubes under water and the use of rubber tissue dressings, to allow for post-operative drainage of the thorax without artificial control of pneumothorax.

Technic of Intratracheal Insufflation Anesthesia.—Apparatus for intratracheal insufflation anesthesia has multiplied rapidly since the popularization of the method by Elsberg. However, all apparatus is similar in certain essentials. The source of air current may be provided by foot bellows, hand-driven or electrically-driven pumps, and tanks of compressed air. The air-current may pass directly into the ether container, or as is more advisable, is stored in a low-pressure tank or gasometer from which it passes into a Wolf bottle, to be heated and moistened, and thence by regulating valve, either directly into, or only partially through, the ether container, thereby providing for aeration pure and simple or insufflation with varying percentages of ether.

Also a source of oxygenation is an expedient adjunct. The tube from the apparatus connects with a mercury manometer and thence to the intubation tube.

Davies, adopting Kuhn's idea of a double intubation tube, uses a manometer to gauge the inlet and outlet air pressures.

All experimenters have concluded that for the Meltzer-Auer technic a silk-woven catheter 30 cm. long and of a diameter one-half that of the glottis, usually from 22 to 26 of the French scale, serves as the best intubation tube. It should have an opening similar to the rectal tube at the tracheal end, should be absolutely smooth and semi-rigid to prevent it from being expelled by coughing or from being compressed while in position.

Its introduction is best accomplished after the preliminary introduction of narcosis by ethyl chlorid-ether or nitrous oxid-oxygen-ether anesthesia.

Intubation is greatly facilitated by means of either the Jackson direct laryngoscope, Fischer's modification of Hayes's instrument, or the introducer devised by Cotton. After the patient has been deeply narcotized the mouth is opened wide

and so held by a gag. The head is well brought forward and the tongue pulled forward by an assistant until the opening of the larynx is brought into view. The metal guide is introduced into the opening and the intubation tube is gently pushed onward until it is seen to pass over the epiglottis into the larynx, after which the metal guide is withdrawn and the tube is pushed further into the trachea until it meets an obstruction, which is either the wall of the right bronchus or the bifurcation of the trachea. It is then withdrawn an inch and is anchored in position to special mouth gags provided for the purpose.

The distance from the incisors to the bifurcation of the trachea is from 9 to 10 inches in the infant, 12 in a child, and about 17 inches in the adult. The glottis in the adult is one-half the distance between the incisors and the bifurcation of the trachea, and Elsberg suggests making the intubation catheter accordingly to insure greater accuracy in adjusting its location.

One-eighth to ¼ gr. of morphine hypodermically ten minutes before the administration of ether to reduce the irritability of the larynx; or from twenty minutes to half an hour previously when preliminary anesthesia by ether is not resorted to. The induction of narcosis by intratracheal insufflation produces spasmodic coughing while the patient remains conscious.

With the intubation tube introduced to the correct position, air may be heard rushing through the catheter. Spasm of the larynx may now occur for a few moments, but is of no consequence. At this juncture the tube from the apparatus is connected to the catheter with the pressure gauge of the manometer controlling the air supply at 20 mm. and the ether percentage at 50. If the lungs are not kept properly distended by a pressure of from 10 to 20 mm. Hg, the intratracheal tube is either out of position in the right bronchus or is too small and is allowing too much air to escape by way of the trachea. In the first instance the tube must be retracted and in the second either a larger sized tube must be introduced or else slight compression of the trachea around the tube at the jugulum must be intermittently utilized. Too large a tube causes CO_2 accumulation and cyanosis.

Complete muscular relaxation is usually obtained with from 50 to 75 per cent. of ether, and during the course of narcosis the breathing is quiet, respirations are reduced by one-third, the face remains pink, while the veins of the forehead become prominent; the pulse usually remains full, bounding, and regular, the pupils do not dilate, and frequently the corneal reflex is active, so much so that the condition of the patient is rather one of analgesia than anesthesia. Reaction from the anesthesia is so rapid that care must be exercised to keep up etherization throughout the entire operation. The depth of narcosis is controlled by increasing the air pressure and the percentage of ether while at the same time avoiding a condition of apnea, which supervenes at pressures of from 30 to 40 mm. Cyanosis and the accumulation of CO_2 during the operative procedure are controlled by periodic deflation and occasional oxygenation with air. Pure oxygen is dangerous on account of its toxicity when its tension becomes too great, and it is too freely absorbed by the circulation.

At the close of anesthesia, ether is turned off, and pure air, or a combination of air and oxygen, is insufflated under slightly increased pressure to blow out the ether from the trachea and alveoli. Patients come out from under the influence of pulmonary anesthesia by this method almost as soon as the insufflation is discontinued and the tracheal tube removed.

While etherization in association with intratracheal insufflation appears to be the safest form of anesthesia for intrathoracic operations, Boothby, after using the nitrous oxid-oxygen-ether technic, has been favorably impressed with the latter method and Willy Meyer also suggests that the innocuousness of nitrous oxid may play an important rôle in conserving patients under thoracotomy the additional shock of a poisonous anesthetic agent.

FOURTH AND BROADWAY.

DISCUSSION.

MAJOR ALLIE W. WILLIAMS, U. S. A., Medical Corps, Washington, D. C.—My interests as a military surgeon are so keen on the subject of intratracheal insufflation anesthesia that on being ordered to Vera Cruz, Mexico, with General Funston's expeditionary forces in April, 1914, I promptly packed up my portable intratracheal insufflation apparatus and loaded it onto the United States Army Transport Kilpatrick at Galveston. Thus my apparatus formed a part of the Army Field Hospital equipment at Vera Cruz.

Although it was a bloodless war after the first two or three days incident to the taking of Vera Cruz and as a consequence I did not have the opportunity to make as much use of my apparatus as had been anticipated. Still, one very interesting case fell to my lot while there. The case was that of a Mexican with a bronchial fistula. The first case I had ever seen. The anesthetic, ether, was administered by intratracheal insufflation, and though infection is the rule in operating on a fistulous opening into the mouth by way of the submaxillary gland, by this method of anesthesia I was able to so perfectly control asepsis that no infection occurred and the outcome was a good result.

There are one or two points in Dr. Ricketts' excellent paper I wish to emphasize, and they are, first, the safety of the anesthetic by intratracheal insufflation. After having found out the amount of ether necessary to the individual the desired depth of anesthesia can be maintained more accurately and unvaryingly by a machine than by hand. An infallible method of artificial respiration is immediately substitutive for the anesthetic if any untoward symptoms arise. With the respiratory system always under your control the action of the heart is practically your only concern. In particular I recall one case in that of a soldier with advanced pulmonary tuberculosis in which it would have been exceedingly hazardous to have depended upon his limited sound lung capacity for surviving an operation on his chest wall, with intratracheal insufflation this danger was absolutely eliminated. The machine did the breathing for him. My experience in the use of intratracheal insufflation anesthesia has been limited to the use of ether as the anesthetic agent.

It has been my observation that post-operative nausea and vomiting is so frequently absent or so slight that it is almost a negligible factor. The absence of nausea and vomiting is explained by the blowing out of the lungs with fresh air after discontinuation of the anesthetic. The residual ether having been blown out of the air cells of the lung, the swallowing of heavily laden ether mucus does not result. Another feature of importance is the diminished shock due to absence of prolonged post-operative anesthesia, whereas by the mask method the post-operative anesthesia may be prolonged from one to three hours. In intratracheal insufflation coincident with the blowing out of the lungs with fresh air consciousness follows in a very short space of time.

In head, neck and chest surgery I feel that intratracheal insufflation anesthesia fills an indispensable place in the practice of surgery in hospitals in the military service.

American Journal of Surgery

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F. HOEFFER McMECHAN, A.M., M.D., *Editor*
Cincinnati, Ohio, U.S.A.

A REPREHENSIBLE PROPAGANDA AGAINST DENTAL ANESTHETISTS.

In the *Medical Times,* September, 1915, Lawrence Irwell, an attorney of Buffalo, N. Y., who for some years has been agitating the problem of the *non-medical anesthetist,* makes the following announcement:

"At the next session of the Legislature (1916) of this state (New York), an attempt will be made to obtain legislation which will provide that the administration of general anesthetics is a part of the practice of medicine. The proposed addition to the law, of which a copy is appended, will not interfere with the lawful rights of dentists, with the employment of any reliable person in an emergency, or with the instruction of medical or dental students. (?)

"A Bill to Regulate the Administration of General Anesthetics by Persons other than Licensed and Registered Physicians.

"The administration by any process of any substance, liquid or gas, commonly called a general anesthetic, for the purpose of producing unconsciousness, shall constitute the practice of medicine and surgery, even if undertaken in the presence of and by order of a licensed and registered physician, surgeon or dentist, with the following exceptions:

"1. A licensed and registered dentist may administer any general anesthetic for any operation which such a dentist can lawfully perform, but not for any operation which a dentist cannot lawfully perform, even if a licensed physician is present and directs such dentist to administer such general anesthetic, except as is hereinafter provided.

"2. In any case of sudden severe illness or sickness in which the licensed physician or surgeon in attendance upon the patient conscientiously believes that the delay necessary to obtain the services of another licensed physician to administer a general anesthetic, will endanger the life or health of the patient, that attending physician or surgeon may employ any reliable person to administer such general anesthetic in his presence and directly under his instructions, but not in his absence. The employment in this manner of any person other than a licensed and registered physician to administer any general anesthetic must be strictly limited to emergencies in which the services as anesthetist of a licensed or registered physician cannot be quickly and easily obtained, and must not be a regular or habitual practice.

"Nothing contained in this statute shall be construed to prohibit necessary practical instruction in the administration of general anesthetics being given to registered medical students by licensed physicians or to registered dental students by licensed dentists or licensed physicians; always provided that *while giving such instruction, the instructor devotes his entire attention to teaching and neither operates nor does any medical, surgical or dental work unconnected with the administration of a general anesthetic.*"

The Editor of the SUPPLEMENT submits that this statute if passed as printed will not accomplish its purpose, but will involve dental and surgical anesthetists in a maze of difficulties. It is an entirely misguided and reprehensible propaganda.

While the SUPPLEMENT is making every effort to abolish the evils involved in the administrations of anesthetics by non-medical anesthetists, it cannot subscribe to the limitations this statute intends to place on the dental anesthetist, and it is hoped that dental associations in New York will give this matter their immediate attention.

The New York Society of Anesthetists welcomes dental anesthetists to its membership, as does the Interstate Association of Anesthetists. In fact, this latter association will have a special section of Dental Anesthetics on the program of its next meeting. Throughout the United States dentists are being gradually admitted into medical associations, and the barriers between the two professions are being obliterated, particularly in the section on Stomatology of the American Medical Association and the Academy of Stomatology, Philadelphia.

This effort to differentiate the respective prerogatives of dental and surgical anesthetists is reprehensible and in direct contravention to the spirit of amalgamating the interests of both professions, which is leavening the American professions of medicine and dentistry.

Section 2 of this statute simply leaves a loophole for future violations of the law; while the final paragraph in *editorial italics* shows how absurd a propaganda of reform may become under the lash of misguided enthusiasm. This section if strictly interpreted and enforced would utterly abolish *dental anesthetic clinics as they have been held for years in connection with state and national dental association meetings.*

Moreover, it would imperil the future of *analgesia,* as a technic of pain-alleviation, in which the surgeon or dentist both administers the anesthetic and operates, and *teaches.*

The utter absurdity of this section becomes the more apparent when it is realized that a similar statute similarly applied would abolish the clinical teaching of surgery.

Finally, the solution of the problems involved in the administration of anesthetics by non-medical anesthetists, lies within the powers of the various state medical boards. All they have to do is to test the legality of the procedure and discipline those licensed and registered physicians who persist in violating not only the medical practice acts of their respective states but the ethics of their state associations as well.—F. H. M.

THE SUPPLEMENT'S FIRST ANNIVERSARY.

It is with pardonable pride that the ANESTHESIA SUPPLEMENT, in completing its first year of existence, points to the fact that it is successfully fulfilling its editorial policy of *service*. With the close of the European conflict the SUPPLEMENT will add the Transactions of the Anesthetic Section of the Royal Society of Medicine, to the list of those already being published, and through the courtesy of their respective Secretaries, the SUPPLEMENT will also print an Abstract of the Proceedings of the Louisville and Indianapolis Societies of Anesthetists.

Further than this the SUPPLEMENT is supporting the activity of certain State Medical Boards in testing the legality of the administration of anesthetics by nurses. This problem now confronting the specialty of anesthesia gives promise of a speedy and favorable solution.

Pending a legal decision, pressure will be brought to bear upon important surgical associations to secure their cooperation in abolishing this abuse.

F. H. M.

CRUMBS FOR THE ANESTHETIST.

A situation has arisen with regard to the anesthetic service of the Cincinnati General Hospital, which deserves the attention of anesthetists throughout the country. The Cincinnati General Hospital is a municipal institution recently completed at an expense approximating *four million dollars*, and is closely affiliated with the University of Cincinnati as its Clinical School of Medicine. More recently a fund of *five hundred thousand dollars* has been subscribed to build a new Medical College Building on the grounds of the hospital.

From the foregoing it would appear that this institution could not only afford the services of a paid anesthetist, but could also make the salary sufficiently attractive to invite applicants for the position.

During the past ten years several members of the INTERSTATE ASSOCIATION OF ANESTHETISTS have at various times acted as Visiting-Anesthetists to the Cincinnati General Hospital, *without recompense*. When the last incumbent resigned because the demands on his time and energy were precipitating him into financial bankruptcy on account of having to neglect his private practice, the municipality finally saw a light and decided to offer the munificent salary of from *fifty* to *seventy-five dollars* a month to any applicant who would pass the requisite civil service examination. The salary was in recompense for full time service, including the distinguished honor of punching a *time-clock*.

Fortunately the anesthetists of Cincinnati and its immediate vicinity were so busy making a decent, self-respecting living by administering anesthetics at other hospitals and for surgeons who appreciated the value of their services, that *not a single anesthetist* showed up to take the civil service examination for the position.

That the position is no sinecure, irrespective of the proffered salary, may be gleaned from the fact that the anesthetist holding down this service must accommodate himself and his methods to the idiosyncrasies of no less than 18 surgeons and specialists.

It is to be hoped that anesthetists will continue in their conviction that they are worthy of their hire, and that they will resent the medico-political economy that places them in the position of Lazarus, begging outside the gates, for crumbs from the table of Dives.

F. H. M.

REFUSAL TO SUBMIT TO ANESTHESIA AND OPERATION IN RESPECT TO WAR PENSIONS.

The following instructions of the Minister of War of France are of especial value to surgeons and anesthetists who are interested in the medico-legal phases of pensions and indemnifications under Workmen's Compensation Acts, as similar instances have already arisen and have been adjudicated in Continental and American Courts:

"The right to refuse a bloody operation, *with or without anesthesia*, is considered absolute in law and jurisprudence, because every bloody operation entails a risk of death. The exercise of this indisputable right of refusal, however, may entail certain consequences. The wounded man may have his final indemnification reduced, especially in the following two cases: (a) when the operation is very trifling and *does not require a general anesthesia* (incision of a superficial purulent collection, or extraction of an easily accessible bullet); (b) when an operation is urgent beyond all doubt, to avoid a complication capable of pro-

ducing an important or absolute incapacity (refusal to submit to the enucleation of a wounded eye in case of threatened sympathetic ophthalmia or to the amputation of a limb in gangrene). In such cases the physician should give the patient friendly advice that the operation offers the sole chance of survival or of minimum infirmity. He should suggest a consultation with one or several physicians, or, if necessary, the removal of the patient to a regional surgical center. If, notwithstanding, the patient persists in his refusal, the physician in charge of the case should draw up a report, giving exact data with regard to the proposed operation, its justification and the patient's refusal with his reasons. This report is to be signed by the patient, the physician in charge of the case and the physician-in-chief.

"With such a report before them, experts are to estimate on a fractional scale the degree which the operation might have reduced the total incapacity for work. When applications for retirement pension or for relief pension are passed on, the functional surplus incapacity caused by the failure to submit to treatment or operation is to be taken into account."

This subject was broached in the British Parliament some years ago and it was decided that it rested with the military surgeons to determine the fitness of a war-pensioner to submit to an operation under an anesthetic for amelioration of incapacity, and that a refusal to submit to the indicated surgery might imperil the continuance of the pension.

In *Shirt vs. The Calico Printers' Association, Ltd.*, tried under the Workmen's Compensation Act (England), a widow was awarded compensation for the death of her husband, who had submitted to a secondary operation for skin-grafting, under an anesthetic, to ameliorate his incapacity.

Similarly the Ohio State Industrial Commission, under provisions of the Workmen's Compensation Law, has on several occasions granted compensation to the dependents of those dying under operative procedures undertaken to ameliorate incapacity.

In *Bourne vs. The Middle Sussex Water Board* (England), it was held that the presence of Bright's Disease, corroborated by the medical experts and examiners which made any operative procedure under anesthesia an extra-hazardous risk, was sufficient legal grounds to establish the plaintiff in his legal rights in refusing operation for the amelioration of his incapacity.—F. H. M.

Book Reviews

A carefully selected library is essential to a thorough knowledge of the science and practice of a specialty.

Hand Book of Diseases of the Rectum. By LOUIS J. HIRSCHMAN, M.D., F.A.C.S., Fellow American Proctologic Society; Lecturer on Rectal Surgery and Clinical Professor of Proctology, Detroit College of Medicine. Octavo; cloth; 340 pages. *Second edition*, revised and rewritten, with 172 illustrations, mostly original, including 4 colored plates. C. V. MOSBY COMPANY, St. Louis, 1914.

Pursuant to the efforts of the American Proctologic Society and some of its individual members, the importance of a clear understanding of the diagnosis and treatment of anorectal diseases has forced itself not only upon the average physicians, but also upon the faculties of medical colleges and universities, with the result that an increasing attention is being devoted to rectal diseases and courses in proctology are being rapidly established.

Hirschman has been a conspicuous figure in this propaganda, and the cordial reception given his Hand Book has necessitated a *second edition*. With an endeavor to make his work more valuable to the general practitioner and to the student, Hirschman has completely revised and rewritten his text. Operative technic has been simplified, new diagnostic methods added, the use of quinin and urea anesthesia described, the value of radiography in proctology illustrated by many plates, and numerous new illustrations, including colored plates, have been inserted to elucidate the text.

This volume is of especial interest to the surgeon, proctologist and anesthetist who are interested in the progress of local anesthesia in anorectal surgery. Speaking before the American Proctologic Society during its recent meeting in San Francisco, Hirschman said: *"In an experience covering several thousand cases of anorectal surgery and over two hundred cases of abdominal surgery performed under local anesthesia, the author, from the satisfactory results of his work, advocates the further employment of local anesthesia, not only in anorectal and intestinal surgery, but also in every phase of surgical activity in which unconsciousness of the patient is not a strict necessity.*

In his Hand Book, after detailing the anatomy of the anorectal region, Hirschman discusses the symptomatology of rectal diseases, and gives valuable instructions regarding the various methods of procedure for examination of the patient for special pathological conditions. Succeeding chapters are devoted to concise and satisfactory expositions of such subjects as Constipation and Obstipation, Fecal Impaction, Pruritus Ani, Anal Fissure and Ulcer, Abscess, Fistula, Hemorrhoids, Proctitis, Sigmoiditis, Dysentery and Prolapse.

Those pages devoted to Local Anesthesia in the Treatment and Surgery of Anorectal Diseases are replete with valuable information regarding the anesthetic agents of choice, the instrumentarium, the general and special technics for routine and unusual procedures. Hirschman displays rare judgment in indicating the limitations of local anesthesia and the office treatment of certain conditions. While an enthusiast, he fully realizes that the use of local anesthesia has its contraindications.

Hirschman has a preference for eucain lactate in fractional percentage solutions, associated with quinin and urea hydrochlorid for prolonged obtunding effects. His routine use of the latter is well in accord with the success of Hertzler achieved in general surgery. He advises against the use of local anesthesia in all anorectal operations *which require extensive dissection or over twenty minutes of time for their completion.* While local anesthesia, associated with general narcosis, is always preferable for radical operations, local anesthesia alone is contraindicated by malignant, syphilitic or tubercular complications.

While Hirschman's volume does not assume the proportions of an exhaustive text-book, it serves the purpose for which it was written, and in the hands of a practical surgeon, specialist or anesthetist, provides all the vital information for making a diagnosis and all the technical details for successfully treating the conditions diagnosed. Further than this, it offers a thorough adaptation of the most improved methods of local anesthesia to the special surgery of proctology.

The Practical Medicine Series: Comprising Ten Volumes of the Year's Progress in Medicine and Surgery. CHARLES L. MIX, A.M., M.D., General Editor; GENERAL SURGERY (Volume II), Edited by JOHN B. MURPHY, M.D., F.R.C.S., Professor of Surgery in the Northwestern University. 602 pp., Index, and Profuse Textual and Plate Illustrations. THE YEAR BOOK PUBLISHERS, Chicago, 1915.

In reviewing the literature of the year (1914), Mix notes a pronounced reduction of the variety of routes for the administration of anesthesia and analgesia. Many who formerly advocated gas, local, spinal and intraneural

analgesias are returning to simple ether by the drop method, preceded by hypodermics of morphin and atropin. Even the use of scopolamin has materially diminished. The newer methods that are being advocated by their masters and are withstanding the test are the intravenous ether and saline of Kummell, the intratracheal method of Meltzer, and the ether-oil colonic method of Gwathmey, especially in operations about the face, neck and head.

Attention is drawn to Barton's use of colored ether and chloroform to obviate mistakes when both anesthetics are used in the same operation or are combined in the C. E. mixtures. Fairlie's investigations of blood-pressure under ether and chloroform are given the attention they deserve, and the investigations of Coburn on the increase in intoxication of ether by newer methods of administration are given in detail. Shipway's experiences with intratracheal anesthesia, based on 208 cases, are recorded, and the incidence of emphysema noted in the cases of Ehrlich, Luke and other observers.

The technic of Kummell's method of intravenous ether-saline anesthesia is given, as is also Gwathmey's technic of ether-oil colonic anesthesia. Attention is drawn to Coble's investigations regarding the production of poisonous aldehyds during vapor anesthesia, when an interrupted stream of ether-ladened air is passed through any heating device above body temperature.

The incidence of after-pain following the use of local analgesia is touched upon in the observations of Honigmann, who suggests the preliminary use of morphin in all procedures that give promise of postoperative pain.

Flemming's statistics on the mortality under anesthetics are emphasized, and are already familiar to readers of the SUPPLEMENT, although a perusal of the original communication to the Anesthetic Section of the Royal Society of Medicine is really worth while.

Throughout the remainder of the volume, various methods of anesthesia and analgesia as they pertain to specific operative procedures are described and commented upon, and this feature of the PRACTICAL MEDICAL SERIES makes it exceptionally interesting to the specialist in anesthesia, who has become a vital member of an operating team, and should be conversant with the relation of the anesthesia or analgesia to any and all operative procedures.

Bodily Changes in Pain, Hunger, Fear and Rage. An Account of Recent Researches into the Function of Emotional Excitement. By WALTER B. CANNON, Ph.D., George Higginson Professor of Physiology in Harvard University. 311 pp., with Textual Charts. Cloth. D. APPLETON & COMPANY, New York and London, 1915.

Recent important discoveries made by the author and his co-workers, de la Paz, Shohl, Wright, Washburn, Lyman, Nice, Gruber, Osgood, Gray and Mendenhall, are described in this book. Pain and the powerful emotions of fear and rage have been found to be accompanied by stoppage of digestion, the setting free of sugar in the body, the abolition of fatigue, the faster clotting of the blood, and by other fundamental changes all favorable to great feats of strength and endurance and to self-preservation in fierce struggle. The author discusses the relation of these emotional changes to the fighting instinct. After showing the inadequacy of modern warfare as a means of giving natural outlet to the activities for which emotions prepare, he suggests alternative satisfactions. So much for the physiological aspects of the subject.

This volume is of interest to the surgeon and anesthetist because the powerful emotions of pain, hunger, fear and rage play an active rôle in the morbidity of operative procedures under all forms of anesthesia and analgesia. Crile, Dolle and Austin, in working out the theory of anoci-association, made the researches of Cannon and his co-workers the basis of their investigations, and established a technic of surgical procedure that would eliminate the bodily changes which precipitated mortality after operations.

While not making the surgical application of his researches, even a cursory perusal of Cannon's book shows one the value of conserving the adrenalin content and output of the body, and preventing operative glycosuria by the preoperative control of excitement and the postoperative elimination of pain. Also the clinical results of Gatch regarding posture and muscular relaxation as factors in shock, find a physiological basis in the explanation of Cannon that the integrity of muscle-tone is of vital significance in eliminating metabolic toxins, the accumulations of which precede relaxation and toxemic complications.

The work is delightfully written, and although ultra-scientific, fascinates by the clearness and vividness with which the author expounds his theories, presents his researches and proves his conclusions.

Society Proceedings

Membership in a society devoted to your specialty is an essential to success.

AMERICAN PROCTOLOGIC SOCIETY.

The American Proctologic Society held its Seventeenth Annual Meeting at San Francisco, June 21 and 22, under the presidency of Dr. Louis J. Krouse, of Cincinnati.

In pursuance of its editorial policy of *service*, the SUPPLEMENT presents author's abstracts of the papers read at this meeting which were of especial interest to surgeons and anesthetists.

THE PRESENT STATUS OF LOCAL ANESTHESIA IN THE SURGERY OF THE LOWER BOWEL.

LOUIS J. HIRSCHMAN, M.D., F.A.C.S.,
Detroit, Mich.

In an experience covering several thousand cases of ano-rectal surgery and over two hundred cases of abdominal surgery performed under local anesthesia, the author from the satisfactory results of his work advocates the further employment of local anesthesia in not only rectal and intestinal surgery, but also in every branch of surgical activity where absolute unconsciousness of the patient is not a strict necessity.

Several essentials to be rigidly observed are: the surgeon's thorough familiarity with contraindications to local anesthesia, the patient's temperament, surgical surroundings, extent of operation, its probable duration, idiosyncrasy of patient, and psychic surroundings as governed by the surgeon himself, must be given serious consideration. The attitude and method of approach of the surgeon and assistants, their conversation and general handling of the case is fully as important as the selection of the anesthetic employed. While many operations can be performed successfully in one's office operating room or the patient's home, it is far better to operate in a modern hospital.

The preparation of the patient should be just as thorough as though general anesthesia was to be employed. It is the author's custom to administer fifteen to twenty grains of chloretone with or without one-fourth grain of morphin with a hot drink an hour before operating. In abdominal cases one-fourth grain of morphin and one-hundredth grain scopolamin is administered hypodermically one-half hour before operating. The patient and the operating room attendants are kept as quiet as possible, success of the local anesthetic being entirely nullified by lack of attention to surrounding details. The operating room is fully prepared before the patient is brought in; instruments, utensils, etc., are kept out of sight and hearing of the patient, and a code of signs and signals used in asking for instruments, pads and other things. The table is covered with a thick pad or mattress, the patient's ears are stopped with cotton and a towel placed over the eyes. The patient is placed in the dorsal position if the operation is abdominal, and the arms placed at his sides, but not strapped or restrained in any way. The iodin skin sterilization is used and assistants and interns taught to constantly keep in mind that the patient is not asleep and all handling should be as gentle as possible. One-eighth of one per cent. solution of belta-eucain lactate is

used for skin anesthesia and a thirty cc. all-metal syringe armed with twenty-six gauge needle is used. The fascia, muscles and peritoneum along the line of incision are surrounded by an ellipse of one-half of one per cent. solution of quinin and urea. One point to remember is not to start the operation too quickly after injecting the anesthetic. Five minutes after eucain and ten to fifteen after the quinin solution should be the minimum wait. Under the proper technic the abdomen can be explored as satisfactorily as if the patient were asleep. By injecting the mesentery of the bowel retraction can be made painlessly. The author always places his colostomies in the median line, using the ceoliotomy wound for the purpose, as it can be better controlled by the patient here than in the flank.

In ano-rectal surgery local anesthesia has reached a high stage of development and is now used in the author's practice in by far the majority of his cases. Practically every operation excepting dissecting of extensive fistulas and extirpation of strictures and cancer can be successfully performed by skilled rectal surgeons under local anesthesia.

The technic of hemorrhoidectomy will serve to illustrate local anesthesia in proctology:

With the patient in the left lateral position, anesthesia of the sphincter muscles is accomplished by blocking the posterior sphincterian nerves at the junction of posterior and middle thirds of the anus. The anterior nerves are anesthetized in like manner. The entire anal circumference is injected from these anesthetized areas. The external hemorrhoids are distended to a waxy white color, pressure anesthesia accomplishing more than chemical strength of anesthetic. After four or five minutes' wait the injected skin is grasped at the four points of the compass with Pennington triangular forceps. Traction of these forceps everts the anus and prolapses the hemorrhoids.

This may be assisted by expulsive efforts on the patient's part. The hemorrhoids, starting with the most dependent one, are anesthetized by distension with one-half of one per cent. quinin and urea solution. After a wait of ten minutes the operation can be started. Note that the use of rectal speculum or dilatating the sphincter is not mentioned. If properly anesthetized, the sphincter relaxes without any effort to dilate, and the four everting forceps expose the operative field in a most satisfactory manner.

In the author's operation the hemorrhoid is seized with the Hirschman forceps in its long axis and a chromic ligature passed into, underneath and around the hemorrhoid at its junction with the healthy mucosa, a curved blunt ligature carrier being used. The ligature is tied securely, leaving one end fourteen and the other five inches long. All hemorrhoids are treated likewise, thus reducing the operative hemorrhage to a minimum. The hemorrhoids are then excised from without with curved scissors, care being taken to remove as much hemorrhoid with as little mucosa as possible. Any varicosities presenting in the wound are carefully excised down to the sphincter mucles. The long end of the ligature threaded into a small, round, curved needle is used to close the wound. It is then tied to the short end and is used more for hemostasis than for coaptation. After all the hemorrhoids are treated likewise, quinin and urea solution is injected under the suture lines for post-operative anesthesia.

The operative treatment of many other diseased conditions of this region can be just as successfully performed under local anesthesia as the types of surgical operations described above.

Among these may be mentioned abscesses, prolapse of the anus or rectum up to the second degree, the removal of polyps, hypertrophied anal papillae, the excision of diseased Morgagnian crypts, the section of hypertrophied rectal valves, the removal of foreign bodies and impactions, Krouse's modification of Ball's operation for pruritus, and many others.

The principles to be observed in all surgical operations under local anesthesia are the conservation of the patient's peace of mind, the prevention of unnecessary pain, both operative and post-operative, the lessening of anesthetic shock, prevention of post-operative pneumonia and nephritis, the shortening of the period of hospital confinement and detention from daily activities, the simplification of surgical technic and detail, the constant reiteration, both in precept and in action, that *the patient is the most important thing to be considered in any surgical operation,* and the use of local anesthesia teaches the surgeon to perform every operation with the least handling and injury to the tissues. What he is *forced* to do in operating under *local* anesthesia, he becomes *accustomed* to do under *general* anesthesia.

The thousands upon thousands of patients who have been successfully treated surgically under local anesthesia, not only in entero-proctology, but in other branches of surgery, offer the best testimony as to the value, efficacy and success of the use of local anesthesia.

THE PANAMA-PACIFIC DENTAL CONGRESS.

The Panama-Pacific Dental Congress met in San Francisco August 30 to September 9, 1915, under the presidency of Dr. Frank L. Platt, and the following papers of interest to dental anesthetists were presented: "Anoci-Association in Dental Operations," Dr. R. H. Riethmuller, Philadelphia, Pa., and "Peridental Anesthesia-Intraosseous Method," Dr. Frank L. Platt, San Francisco, Cal. The SUPPLEMENT presents herewith abstracts of these papers.

ANOCI-ASSOCIATION IN DENTAL OPERATIONS.

RICHARD H. RIETHMULLER, Ph.D., D.D.S.,
Philadelphia, Pa.

Today the anomalous situation that, though dentistry has discovered and perfected to a high degree the technic of nitrous oxid-oxygen anesthesia, many of its disciples after a perfunctory trial have abandoned its practice, and without anything like just grounds have condemned it wholesale, while their condemnations in reality are nothing more nor less than a confession of inefficiency and lack of close application. Thus while in the dental profession many are deprecating the value of nitrous oxid anesthesia in surgery, such men as Crile and Lower have welded the method with that of local anesthesia into a new technic of *anoci-association.*

In justice, however, it should be said that a few members of the dental profession have labored industriously to perfect and safeguard for dentistry the remarkable aid which, in every sense of the word, is dentistry's own merit. Experiments are under way as to the effects of nitrous oxid on blood-pressure, on the chemistry of the blood, on respiration and the secretory organs, being conducted notably by the investigators working under the auspices of the class of anesthesia of the Academy of Stomatology of Philadelphia, and some very striking data are being reported. But it can hardly be asserted that the profession at large has lent its due share of support by closely observing and reporting the effects of nitrous oxid alone or in combination with other anesthetics, upon the respiration, circulation, metabolism and psyche of patients of all ages and conditions of health. Here is a most fertile field for that earnest co-operation of the practical with the theoretical man, which is being more and more generally urged.

Every individual is a cosmos in himself and demands a painstaking selection and modification of the anesthetic means particularly suitable for his, *and only his,* case. Personal, physical, emotional, traditional, environmental, racial, climatic and many other factors and their particular mixture in each patient determine the selection of the anesthetic method of choice or its modification to meet individual requirements.

Nitrous oxid-oxygen anesthesia may be indisputably considered the safest general anesthetic, and combined with local anesthesia and the other elements that go to make up the newer concept of anoci-association, is by far the pleasantest and most satisfactory method of aleviating operative pain and postoperative distress.

Anoci-association is based on Crile's *kinetic theory of shock,* which holds that fear, worry, physical injury, infection, hemorrhage, excessive muscular activity, starvation and insomnia, to say nothing of pain, produce alterations in the cellular elements of the brain, suprarenals and

liver, resulting, if not counteracted, in a disintegration of these cellular elements. Now the brain, adrenals and liver may be protected from noxious impulses by the use of nitrous oxid-oxygen anesthesia, which is the least destructive form of anesthetic, coupled with local anesthesia and certain pre- and postoperative precautions. While the application of anoci-association in accordance with its surgical technic is too complicated for average dental operations, yet the technic suggests many means by which the shock and distress of dental operations may be obviated.

Aside from a strict attention to the comfort of the patient in the dental chair, and a general fastidiousness about cleanliness of person, instrumentarium, etc., a painstaking knowledge of the technic and possibilities of nitrous oxid-oxygen anesthesia is an essential detail and should be acquired by persistent and consistent study of all the problems involved.

The preliminary use of bromural, chloral hydrate, camphorated validol, or morphin and scopolamin, are sedative measures required in all cases in which nervous, high-strung and sensitive patients present themselves for dental operations. Alcoholics and muscular individuals especially require the use of powerful sedatives.

While a combination of general and local anesthesia may be necessary in graver dental operations, anoci-association methods are possible with local anesthesia alone, provided attention is paid to details, such as the proper psychic preparation of the patient, the use of preliminary sedatives, the painless insertion of the needle and delicate manipulation of all instruments and the tissues operated upon. Conductive anesthesia will enable the dentist to use anoci-association in the presence of acute inflammatory and other pathological conditions, in which direct obtunding of the operative field would be impossible without unendurable pain.

However, only a thorough mastery of its technic, coupled with an appreciation of the importance of correct isotonia, dosage, temperature and sterility of solutions, and the strictest adherence to asepsis in every phase of the operative procedure will lead to successful results.

Should light symptoms of collapse appear, such as pallor, nausea, palpitation, rapid pulse, perspiration or trembling, a decoction of black coffee, aromatic spirits of ammonia or camphorated validol may be advantageously given. The inhalation of amyl nitrite, placing the patient in a recumbent position, heart stimulation by the hypodermic injection of camphor in oil, inhalation of oxygen and artificial respiration, must be resorted to in proportion to the gravity of the symptoms arising and the response to restorative measures.

Postoperatively, a painless and rapid process of repair is best assured by protecting wounds against external stimuli and irritation of the traumatized tissues by spraying or tamponing with pure orthoform or novocain powder, according to the method of Spiess, after previous antiseptic dressings with 10 per cent. iodoform or europhen. No inflammation will develop if the reflexes conveyed by way of the afferent nerves from the traumatized area by way of the afferent sensory nerves are successfully blocked by anesthesia, and the normal function of the vasomotor nerves is not interfered with. Internally, the administration of trigemin, pyramidon, aspirin or combinations of these sedatives will render excellent service in preventing post-operative shock and allaying after-pain.

PERIDENTAL ANESTHESIA-INTRAOSSEOUS METHOD.

FRANK L. PLATT, D.D.S.,
San Francisco, Cal.

Peridental anesthesia is valuable in obtunding teeth or roots standing singly, or teeth affected by pyorrhea or similar chronic peridental disturbances. Anesthesia is accomplished by injecting the analgesic agent directly into the peridental membrane. In single-rooted teeth a fine and short hypodermic needle is inserted under the free margin of the gum, or through the interdental papilla, into the peridental membrane between the tooth and the alveolar wall. Occasionally the needle may be forced through the thin alveolar bone so as to reach the peridental membrane direct.

In teeth set close together, separation is essential to gain access to this membrane. This may be readily accomplished with an orange wood stick or by any of the mechanical separators. By this means the body of the tooth is shifted to one side, and in the slight space between it and the alveolar process there is room sufficient to introduce the hypodermic needle. The injection is now made directly into the exposed peridental membrane. By reversing the separator, the tooth is shifted to the other side and the injected analgesic is forced toward the apex of the tooth. A second injection is now made into this freshly exposed portion of the peridental membrane. It usually requires a higher pressure to inject the analgesic into the peridental membrane than into the periosteum covering the alveolar process, but the quantity of the anesthetic solution required is less. Peridental anesthesia is the purest form of local anesthesia, since the seat of the nerve supply of the tooth is very quickly and almost directly reached, and consequently the results obtained are extremely satisfactory. The method is available for the removal of pulps in such cases in which contact anesthesia is not indicated or for temporarily obtunding a tooth for operative procedures. The method is contraindicated in the presence of acute inflammatory conditions of the peridental membrane.

The intraosseous method of peridental anesthesia was introduced by Otte in 1896, and consists in forcing the anesthetic solution directly into the spongy cancelloid bone. The technic of injection is as follows: After the gum tissue is thoroughly cleansed with an antiseptic solution, it is anesthetized about the neck of the tooth in the usual manner. After waiting two or three minutes an opening is made into the gum tissue and the bone on the buccal side with a fine spear or Gates-Gidden drill. The opening is preferably made at a right angle with the long axis of the tooth, a trifle below the apical foramen in silge rooted teeth, and between the bifurcation in the molars. The right angle hand-piece of the drill is employed for this purpose. The drill must be of the same gauge as the hypodermic needle. The gum fold is tightly stretched to avoid laceration from the rapidly revolving drill.

As soon as the alveolar process is penetrated, a peculiar sensation to the guiding hand indicates that the alveolus proper has been reached. The drill is now withdrawn and the hypodermic needle substituted and the injection made in the ordinary way. Only a small quantity of the anesthetic solution is required. The roots of the teeth are imbedded in a sieve-like mass of bone, the diploe, which permits a ready penetration of the fluid when injected under pressure.

More recently Masselink has advocated this method of anesthesia for obtunding any tooth in the mouth for the purpose of extracting or the removal of its pulp. A No. ½ round burr is employed for penetrating the alveolar plate, and a short (1-16 inch) needle with a dull point is used for the injection.

AMERICAN ASSOCIATION OF ANESTHETISTS.

The Third Annual Meeting of the American Association of Anesthetists was called to order in Hall D of the Civic Auditorium, San Francisco, Cal., at 9.30 on the morning of June 21, 1915, with President Dr. Charles K. Teter, of Cleveland, O., in the chair. The minutes of the previous meeting at Atlantic City were accepted as read by the Secretary, Dr. James T. Gwathmey.

Following a precedent established by the Association, only applicants to membership who had a medical degree were elected to Fellowship. Exception had been made in the past in electing several dentists to Fellowships and important offices, but these honors had been conferred on account of outstanding work in the advancement of anesthesia. The applicants were elected to Fellowship by a ballot cast by the Secretary for the Association.

Upon motion of Dr. Botsford, the Secretary cast the ballot of the Association for the unanimous election of the following nominated officers: President, Dr. Willis D. Gatch, Indianapolis, Ind.; Vice-Presidents, Dr. Walter M. Boothby, Boston, Mass.; Dr. F. W. Nagel, Montreal, Canada, and Dr. Isabella C. Herb, Chicago, Ill.; Secretary-Treasurer, Dr. James T. Gwathmey, New York City; Members of the Executive Committee, Dr. Albert H.

Miller, Providence, R. I., and Dr. Paul Lux, Kansas City, Mo.

While Dr. Willis D. Gatch, the newly elected President, is not an active anesthetist, but Professor of Surgery in the University of Indiana Medical School, he was nominated and elected to this position on account of his researches in the theory and practice of anesthesia, and in compliment to his activities in behalf of the American and other associations of anesthetists.

After some discussion Article III of the Constitution, upon motion of Dr. E. I. McKesson, was amended so that while qualifications for memership remain the same, no limitation of number will restrict the Association in increasing its membership.

The report of the Treasurer was accepted as read.

During the two scientific sessions the following papers were read and discussed: President's Address: Nitrous Oxid-Oxygen Anesthesia in Obstetrics, Dr. Charles K. Teter, Cleveland, O.; Nitrous Oxid-Oxygen Anesthesia, Dr. Mary E. Botsford, San Francisco, Cal.; Color Changes and the Margin of Safety in Nitrous Oxid Anesthesia, Dr. Douglas H. Morse, Pomona Valley, Cal.; Blood-Pressure Under General Anesthesia, Dr. E. I. McKesson, Toledo, O.; Use of Colloidal (Gelatin) Solution in Low Blood Pressure, Dr. James J. Hogan, San Francisco, Cal.; Personal Experiences with Anoci-Association, Dr. Wallace Irving Terry, San Francisco, Cal.; Some Basic Principles of General Anesthesia, Dr. Carl G. Parsons, Denver, Colo.; The Rate of Evaporation of Ether from Oil-Ether Mixtures and Its Relation to Colonic Anesthesia, Prof. Charles Baskerville, New York City; Sacral Analgesia for Operations on the Sigmoid and Colon, Dr. Jerome T. Lynch, New York City; Factors Other than Anesthetic Causing Danger in Anesthesia, Dr. F. D. Bullard, Los Angeles, Cal.; Ether as an Antidote to Cocain and Novocain, Dr. J. E. Engstad, Minneapolis, Minn.; Some Features in the Evolution of Modern Anesthesia, Dr. Roland E. Skeel, Cleveland, O.; The Importance of Raising the General Standard of Anesthesia, Dr. Mary V. Madigan, Portland, Oregon; Ventricular Fibrillation as a Factor in the Causation of Chloroform Syncope, Dr. Edward H. Embley, Melbourne, Australia; Anesthesia in Status Lymphaticus, Dr. J. Margaret Roberts, Los Angeles, Cal.; Accidents During and Following Anesthesia, Dr. Isabella C. Herb, Chicago, Ill.; Apparatus for Pharyngeal Anesthesia for Nose and Throat Surgery was presented by Dr. A. E. Rockey, Portland, Ore.; an Apparatus for Intratracheal Anesthesia was presented by Dr. Saxton Temple Pope, San Francisco, Cal.; and a new Apparatus for Vapor Anesthesia and Resuscitation was presented by Dr. James T. Gwathmey, New York City.

The Transactions will be published in full in the SUPPLEMENT.

A banquet at the St. Francis Hotel, to which the ladies in attendance were welcomed, completed the meeting. In accordance with the custom of the Association, the next meeting will be held in Detroit, Mich., just prior to that of the American Medical Association.

Newer Apparatus

Editor's Note: From time to time this Department will publish Illustrations and Technical Details of the Newer Apparatus for Anesthesia and Analgesia.

AN APPARATUS FOR VAPOR ANESTHESIA AND RESUSCITATION.*

JAMES TAYLOE GWATHMEY, M.D.,
New York City.

The need for an inexpensive portable apparatus for endo-tracheal and ether vapor anesthesia resulted in this apparatus. The complete apparatus exclusive of carrying case weighs less than fifteen pounds. It is 16 inches long, 8½ inches deep and 5¾ inches wide.

* Presented during the Third Annual Meeting of the American Association of Anesthetists in San Francisco, June 21, 1915.

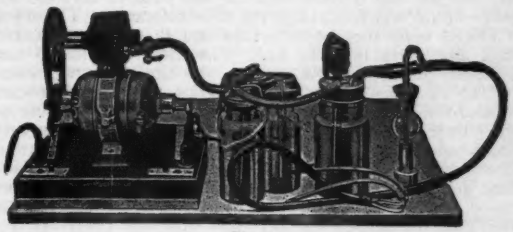


Fig. 1.

Fig 1 represents the apparatus assembled for endo-tracheal or endo-pharyngeal anesthesia. It consists of four units: (1) motor, blower and rheostat; (2) the ether container; (3) a mercurial manometer registering from five to fifty millimeters, which can be instantly set for the pressure required for any operation and acts thereafter automatically; (4) an electric hot water heater for adding both heat and moisture to the vapor. A valve placed just outside of the heater automatically closes if back-pressure ensues at any time, thus throwing the pressure upon the manometer, which acts instantly. The lungs are collapsed by turning the *handle* of the two-way stop-cock on the rotary pump back and forth two to four times a minute.

Elsberg relates an accident which occurred in using an apparatus evidently similar to the three-bottle vapor inhaler by the anesthetist attaching the tube from the pump to the outlet instead of the inlet, thereby pumping pure ether vapor into the lungs of the patient. This accident cannot possibly occur with this apparatus, as all of the ether would be pumped first into the water bottle of the three-bottle vapor inhaler and then into the hot water heater, so even if such a mistake occurred, it would be almost impossible to pump pure ether into the patient's lungs.

This apparatus will do the same work as another occupying three times the space in the operating room.

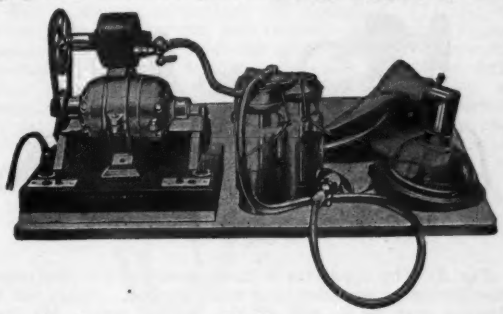


Fig. 2.

Fig. 2. The apparatus is assembled for the closed ether method, with the re-breathing bag so close to the patient's mouth that the ether vapor is warmed by the patient. The initiatory anesthesia may be made in any of the usual ways and continued with the closed vapor method.

Restrictions placed upon the closed method by laboratory workers and others do not pertain to ether when given in this way. The patient is sufficiently oxidized at all times and acidosis is impossible. A continuous supply of ether vapor, continuous rebreathing and a constant escape of part of the rebreathed air takes place. The method of anesthesia recommended is the Woolsey-orange-ether sequence.

The technic is as follows: The *water* bottle (under place marked *air* on the index) of the ether container is filled with three ounces of water in which are placed one to two drams of the Oil of Orange (25 per cent. Oil of Bitter Orange Peel, 75 per cent. of alcohol). Four to six drams of ether are placed in the small *chloroform* bottle. Chloroform should not be used with this apparatus at any time. Four ounces of ether are placed in the *ether* bottle. The index of the three-bottle vapor inhaler is turned to

air, and the bag is filled with the air pumped through the *water* bottle which contains the Oil of Orange. The mask is placed upon the patient's face and the patient breathes back and forth into the bag. The motor is started and sufficient air is pumped to keep the bag over two-thirds full at all times. The index is gradually turned toward *chloroform*, the receptacle in which four to six drams of ether have been placed. The patient is now getting a very small amount of ether which is apparently imperceptible. The index gradually is turned to full *chloroform*, the patient getting more and more of the mild, attenuated ether vapor. If at this time the patient coughs, sneezes, or swallows, or shows in any way that he perceives the ether, the index is immediately turned back to *air*. The same procedure is repeated until the index reaches full *chloroform*. The patient will now be found to be in a state of full surgical anesthesia, the average time required to reach this stage being four to six minutes. When this is accomplished the index is turned back to *air* again and gradually turned toward *ether*. Anesthesia is maintained with the index turned from one-eighth to one-quarter of an inch from *air*, but between *air* and *ether*, the percentage being regulated according to the patient's condition. The expiratory valve is at all times slightly open. The bag remains moderately distended, a slight positive pressure being a decided advantage in some cases, the expiratory valve permitting a continuous but small escape of air.

The breathing with this form of anesthesia is quiet and regular, approximating the breathing in chloroform anesthesia more nearly than that usually seen with ether. The lid reflex is absent, the eyeballs are rolling, but the patient is sufficiently relaxed for all surgical operations. The usual amount of ether used with this method is two or three ounces for the first hour and one ounce for the second. The patient goes under in practically the same way as with a good nitrous oxid-ether sequence. There is no struggling or other indications of a second stage. The pulse is normal, the color reflex unusually good. Woolsey has given over 500 anesthesias with this method.

Regardless of the method of induction, the technic for maintaining anesthesia with the closed method will be the same as that just outlined:

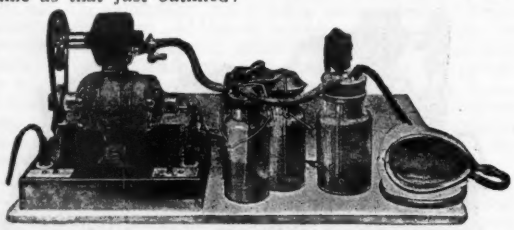


Fig. 3.

Fig. 3. The apparatus is now assembled for pharyngeal insufflation or the semi-open mask method. Again the induction may be in any of the various ways. My own preference for the induction for the open method is the essence of orange-chloroform-ether sequence, the technic of which is as follows: With morphin or some other hypnotic as a preliminary, place two to six drops of the alcoholic solution of oil of bitter orange peel upon the vapor mask, this mask being encircled with a towel. The drop method of chloroform will now proceed to the second stage. When this is reached, give one drop of ether every fifteen seconds for one minute or more, according to the condition of the patient, then alternate the drops of ether with chloroform and finally, as the third stage is reached, continue with ether. This is a very safe way to induce anesthesia, for the reason that the struggling stage does not occur when careful attention is given to the small details. As soon as the patient is under the drop method, the motor is started and the handle of the index gradually turned between *air* and *ether* as just described for the closed method. With the index handle about one-third of an inch from *air*, anesthesia is easily maintained. The index handle will be varied very slightly according to the way in which the patient responds to the ether vapor.

The reason for not inducing anesthesia with the *ether vapor* (for the open or semi-open method) is that it takes too long a time to get the patient under, and there is usually a second stage. The vapor is sufficiently strong to *hold* any patient, *after* surgical anesthesia is established.

Electric Heater: The question as to whether or not ether *can* be heated is now past the controversial stage. There are many ways of heating the ether vapor, but the hot water seems to be the preferable, inasmuch as moisture is added to the heat. Brüning has made very careful experiments in regard to moisture, his conclusions being that when the moisture is below forty per cent, or above one hundred per cent, it is harmful, and suggests fifty to eighty per cent as the required amount. Thermometers and humidors might be added to this apparatus, which would make it very exact, but also quite *complicated*, thus defeating the object for which this apparatus was designed. Experience with a large number of cases has shown that for practical purposes the heat may be regulated as follows: With water in the hot water heater just above the shoulder of the metal electric heater, the heat is turned on by pressing the electric button. The water will be seen to boil and bubble *around* the metal heater in one-half to two minutes (according to the original temperature of the water placed in the container). When this occurs, the heat is turned off. It will be found that the ether vapor after passing over this water is *warm* (it should *never* be *hot*) to the sense of touch at the end of the rubber tube to which the mask is attached. It will continue warm for ten to fifteen minutes, when the electric button is again touched and left on for a half minute, when it is turned off again. In this way the heat of the ether vapor is easily regulated.

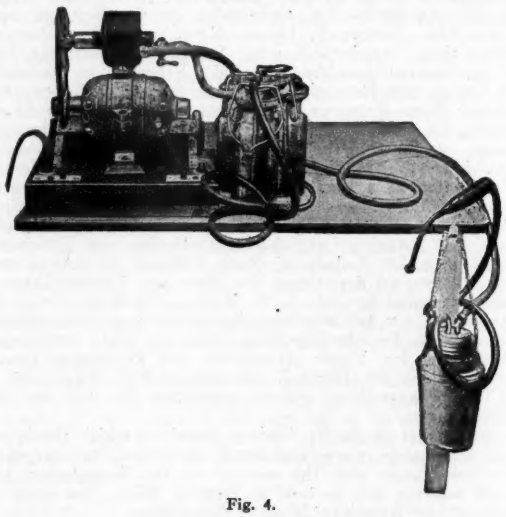


Fig. 4.

The fact that it takes twice as long to kill an animal with warm ether vapor as with cold, is sufficient reason for recommending it when using the open and semi-open methods. Again, in an experience of many thousand cases, two cases in which ether pneumonia occurred, no method of heating the ether was used. Furthermore, the patients come out of the anesthetic much quicker, and seem to be in much better general physical condition in every way when the ether is slightly warmed.

Joss finds that ether cools the air inhaled 33 to 44 degrees below the temperature of the room. The cooled air undoubtedly lowers the resisting powers of the cilia of the ciliated epithelium lining the upper air passages, when these passages become chilled. Infection is more liable to find its way into the finer air passages, as salivation increases under the chilled anesthetic.

There are many others, but these are sufficient reasons for advocating the warmed ether vapor in preference to the cold. *The semi-open vapor method will appeal strongly to those surgeons accustomed to the open drop method. No human hand can deliver as even an ether vapor as an electric motor used in this way.*

Fig. 4. Here the apparatus is especially arranged for adenoid and tonsil work with the suction apparatus added. *The patient must be in deep surgical anesthesia before the pharyngeal or mouth tube is placed in position.* The motor must be speeded up by pushing the button on the rheostat two-thirds the distance from the weak end. The small chloroform bottle is discarded and both the *ether* and *chloroform* bottles filled with ether. Some patients, as a child under four years of age, can be carried with the attenuated vapor when the index is turned somewhere between *air* and *chloroform.* When a stronger ether vapor is indicated, the index is placed between *air* and *ether.* When a still stronger vapor is indicated, the index is turned between *chloroform* and *ether,* thus drawing from both bottles. Care must be taken not to leave this last mentioned vapor on too long; as soon as the desired depth of anesthesia is reached, it can be maintained by turning back and getting the ether supply from the bottle required.

The Suction Apparatus: It will be found that sufficient suction is usually available without any further manipulation. The suction tip placed in the throat will prevent any blood from being swallowed, and the patient usually comes out in much better condition and with less nausea and vomiting than when this procedure is omitted. If strong suction is required, the double airway valve on the rotary pump (to which a tube is attached that conducts the air to the ether container) is used. The handle of this valve is turned so that all of the air goes into the room instead of through the ether container. It will be found that the suction is thus doubled. The handle may then be turned back. During the time that the strong suction is in use the patient will not be getting ether vapor, but as this strong suction is only used for one-half to one minute it will not interfere with the narcosis; for instance, immediately after excision of a tonsil, the strong suction is used which prevents any blood whatever from going in the throat; it is then turned back again. Again, immediately after the adenoids are removed, the suction is again turned on for thirty to forty seconds, and if a continuation of the anesthesia is not demanded from some unusual bleeding from the tonsils, it is continued to the end of the operation. The same technic would apply in any nose and throat operation, such as excision of the tongue, etc. In these longer operations, however, the electric heater should be used.

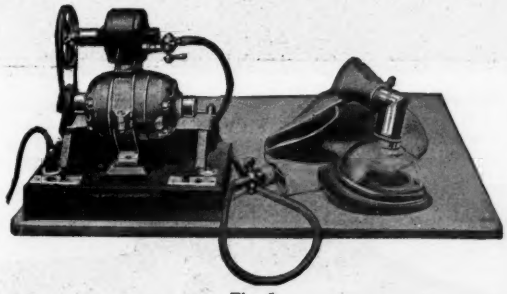


Fig. 5.

Fig 5. Assembled in this way the apparatus is used for resuscitation. It can be carried to the bedside and used wherever an electric attachment is available. The technic is as follows: Place a tightly fitting mask over the patient's face and push the button on the rheostat two-thirds or to the extreme *strong* end of the rod. Allow the rubber bag to fill to slight over-pressure; it will be found now that the patient's lungs are expanded. Turn the obturator on the chimney piece so that the air from the patient's lungs will escape into the room. Then turn back again so that the air from the bag will again fill the patient's lungs. Repeat this fifteen times a minute.

When the apparatus is assembled for intra-tracheal anesthesia, and resuscitation is attempted intra-tracheally, the patient's lungs may be expanded and collapsed by simply turning the handle of the two-way stop-cock on the pump back and forth as required.

The Ether Container (*See Figs.* 1, 2, 3 *and* 4): This container has been used since 1905. By turning the handle of the stop-cock, which is the indicator, any desired percentage of ether vapor is secured. The reason for using this container in preference to the drop method or merely passing the air over the ether, is that we get a purer ether vapor than otherwise. Baskerville, after passing ether vapor through the water in the bottle of the three-bottle container, and collecting the ether distillate obtained under these conditions, found that it gave a negative reaction for aldehyd. He stated: *"The aldehyd content of the ether passed through is considerably diminished and its toxic value is especially lessened when the water is kept at a temperature in the neighborhood of* 60° c.

The total amount of ether used in any given operation is quickly ascertained. The percentage of ether necessary to maintain anesthesia is readily calculated by the *bead* in the ether bottle. But the *patient* is the principal index in all anesthesias.

The *volume* of air is easily regulated by the rheostat.

The *suction* or *collapse* of the lung is regulated by the two-way stop-cock on the rotary pump.

The *amount* of ether is regulated by the index handle on the ether container. The ether vapor is then moistened and heated as already indicated. It will be found that under these conditions a patient's pulse, respiration, temperature, reflexes and color index will more nearly approach the ideal than any present method for giving inhalation anesthesia. To a superficial observer these may seem minor and unimportant details, but results amply justify their combined use.

AN APPARATUS FOR NITROUS OXID-OXYGEN ANALGESIA IN OBSTETRICS.*

CHAS. K. TETER, D.D.S.,
Cleveland, O.

This apparatus is portable and provides a yoke for one cylinder each of nitrous oxid and oxygen. The gases passing from these are reduced by means of pressure reducing valves, surrounded by a hot water heating appliance, from which the gases are led into a sight-feed controlled by separate valve for each.

The following advantages are presented: (1) the nitrous oxid and oxygen are reduced from high to low pressure as they flow from the cylinders; (2) the operator is enabled to secure accuracy of dosage as well as accuracy of control of the air supply through the nasal inhaler; (3) freezing up of the nitrous oxid is eliminated by means of a specially designed hot water chamber surrounding the reducing valves; and (4) the sight-feed

*Presented during the Third Annual Meeting of the American Association of Anesthetists, San Francisco, June 21, 1915.

enables the obstetrician or anesthetist to accurately guage the amount of gas delivered to the patient.

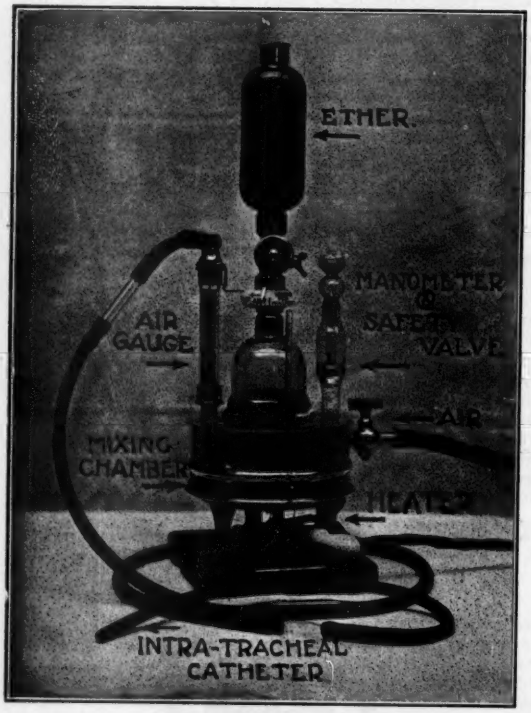
The nasal inhaler is adjustable to any face and is held in place by retention straps. It is also provided with valves to allow the admixture of air if desired.

APPARATUS FOR PHARYNGEAL AND INTRA-TRACHEAL ANESTHESIA.*

SAXTON TEMPLE POPE, M.D.,
Instructor in Surgery, College of Medicine, University of California, San Francisco, Cal.

This apparatus is so constructed that its mixing chamber rests on an electric heater controlled by a switch and rheostat. It receives a constant stream of air from a Columbia dental air pressor driven by a small motor. The ether dropper above the mixing chamber permits very accurate dosage in drops of ether per minute.

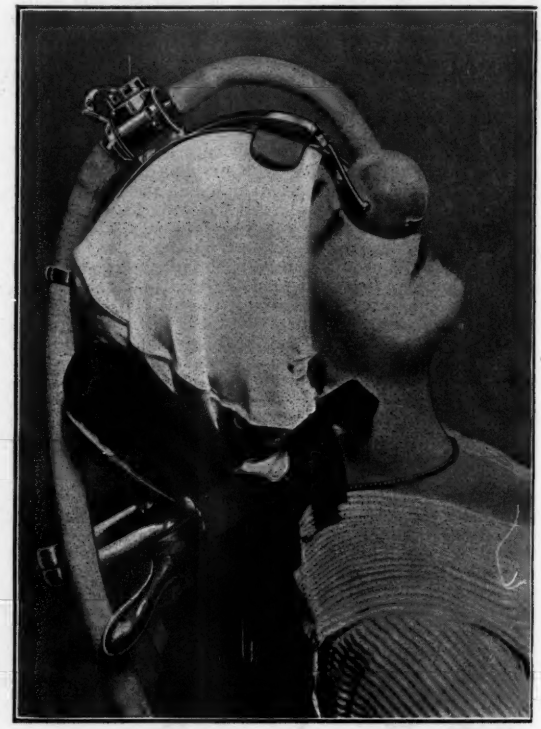
A safety valve and manometer combined prevent accidental overpressure and register it in mm. of Hg. A floating pin wheel in the exit tube indicates the volume of air passing per minute, while a thermometer entering the mixing chamber indicates the warmth of the air-ether mixture.

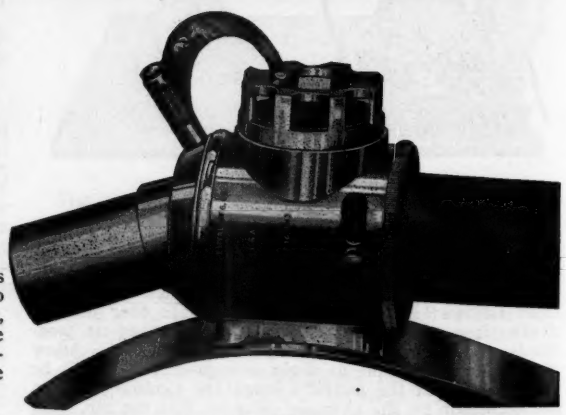


With these features a very accurate and safe anesthesia may be administered either by means of pharyngeal or intra-tracheal insufflation. This particular apparatus has been in use at the University Hospital during the past two years and has made possible operations in the open thorax, as well as having been of very material service in the surgery of the head and neck. It was developed experimentally in the laboratories of Surgical Research, College of Medicine, University of California.

A NEW NASAL INHALER FOR NITROUS OXID-OXYGEN ANESTHESIA AND ANALGESIA.

The essential feature of the S. S. White Nasal Inhaler is a soft rubber nose-piece with rounded edge, adjustable to any form or size of nose with a short, flexible rubber tube extension. It is supported by a steel band curved approximately to the shape of the head, and extending from the occiput to the forehead. The band is clamped firmly, but gently, to the head by the rubber pads resting on the forehead and the occiput. The pads at the back are adjustable by a sliding extension of the head-band. At the crest of the curve of the head-band the valve-body of the inhaler is permanently fixed, with a connection at each end, for adjustment of the nose-piece and the tube from the gas machine, this latter tube being electrically warmed throughout its length.





Metal arms are pivoted to a resilient spring plate attached to the head-band, and are freely and separately movable, permitting the shaping of the nose-piece to conform with any size nose or distortion of the face. An adjuster strip at the lip end of the nose-piece renders it adjustable for short upper lips, or for free access to the cervical margins of the upper teeth. Pressure on the nose or lip can be adjusted by opening or closing the frictional

*Presented during the Third Annual Meeting of the American Association of Anesthetists, San Francisco, June 21, 1915.

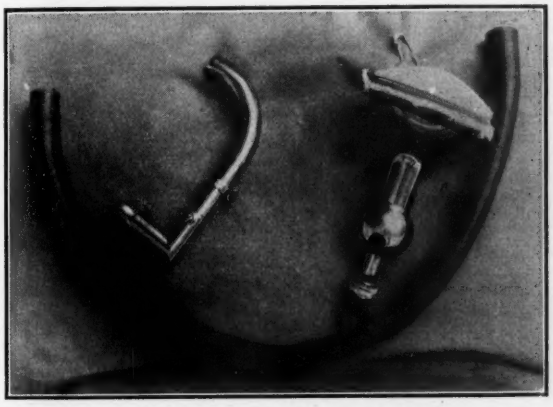
connection between the extension of the nose-piece and valve-body.

The valve-body carries the inhaling and exhaling valves, discs of mica lying loosely in open cribs; the former internal, the latter external, with a clamp and lever for their control. By adjusting the valve-clamp and lever, the operator has at his command, with instant change from one to the other, the three methods of inducing and maintaining non-asphyxial anesthesia or analgesia: (1) rebreathing; (2) straight inhalation of nitrous oxid and oxygen; and (3) inhalation of nitrous oxid with atmospheric air.

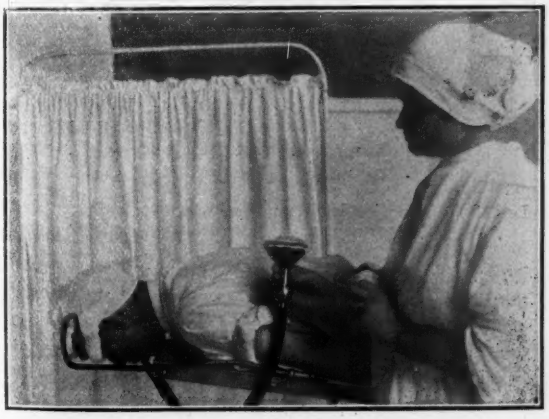
A PHARYNGEAL INHALER FOR ANESTHESIA IN OPERATIONS OF THE JAWS, HEAD, NECK AND CERVICAL SPINE.*

A. E. Rockey, M.D., F.A.C.S.
Portland, Oregon.

The original of the device herewith presented was conceived in 1906 (*Medical Record*, June 2, 1906), and has since been modified and perfected. While intra-tracheal anesthesia has in some measure supplied an efficient method of anesthesia for head and neck surgery, however, the apparatus which I am presenting to you today has so many advantages over the newer method, in many cases, that I feel warranted in bringing it to the attention of this association of specialists in anesthesia.



It consists of three parts: (1) a reversible pharyngeal tube; (2) a long rubber connecting tube, and (3) a funnel so constructed that surplus ether cannot run into the pharyngeal tube. The funnel is also provided with a side opening for finger control of air-admixture and a groove and spring for holding the gauze. (Fig. 1.)



A preliminary hypodermic injection of atropin gr. 1-100 to dry up the mucus, and of morphin gr. 1-6 to diminish the reflexes, is very desirable. Complete ether narcosis by the ordinary method is first produced. The throat piece is then inserted and the mouth around the tube packed with one large piece of gauze. This must be thoroughly done to secure perfect respiration through the tube and in operations on the jaw to protect the pharynx from blood. Anesthesia is then most satisfactorily maintained by dropping ether on the gauze covering of the funnel, and the anesthetist is well out of the way of the surgeon.

The large tube gives about the right quantity of rebreathed ether to each respiratory movement. In operations on the cerebellum or in laminectomy on the cervical spine, when the patient is in the prone posture with the forehead supported on a Cushing head-rest (Fig. 2), the tube may be secured in position by a piece of adhesive plaster passed across the face. The comfort with which anesthesia may be safely and satisfactorily maintained in these critical cases by the proper use of this device is most gratifying to the surgeon and anesthetist. After ten years of use, I consider it the most serviceable method of anesthesia I know of for surgery of the head, neck and cervical spine.

*Presented during the Third Annual Meeting of the American Association of Anesthetists, San Francisco, June 21, 1915.

Index and Abstracts

A Résumé of the International Current Literature of Anesthesia and Analgesia.

EDITOR'S NOTE: Authors of pertinent articles, who desire to have them indexed and abstracted, are cordially invited to send copies of the journals containing their contributions, direct to the editor, immediately on publication. Also the receipt of reprints for filing and reference will be duly appreciated.

Anesthesia, Choice of. T. E. Abernathy, Chattanooga, Tenn. International Journal of Surgery, August, 1915.

Anesthetics, Action of in Preventing Increase of Cell Permeability. P. E. McClendon, Minneapolis. American Journal of Physiology, August, 1915.

Anesthetics, General. L. M. Jacobs, Philadelphia, Pa. New York Medical Journal, June 5, 1915.

Anesthetist, Non-Medical, the Case Against. Lawrence Irwell, Buffalo, N. Y. Medical Times, September, 1915. (See Editorial.)

Anoci-Association in Dentistry, a Review of the Present Status of. Rich. H. Riethmüller, Philadelphia. Dental Cosmos, July, 1915. (See Society Proceedings.)

Apparatus—Etherometer, Means for Mechanical Anesthesia. F. Montgomery, New York City. American Journal of Obstetrics, July, 1915.

Apparatus—Modified Gas-Ether-Oxygen Apparatus. T. L. Dagg, Chicago, Ills. Surgery, Gynecology & Obstetrics, July, 1915.

Apparatus—New Gas-Oxygen-Ether Apparatus. H. C. Luke, New York City. Medical Record, June 12, 1915.

Apparatus—Pulmotor Resuscitation Demonstration. B. F. Stevens, El Paso, Texas. New Mexico State Medical Journal, May, 1915.

Apparatus—Simple and Safe Somnoform or Ethyl Chlorid Inhaler for Minor Operations. B. W. Hornabrook, London. Journal Royal Naval Medical Service, July, 1915.

Blood, Coagulation Time of, Influence of Certain Anesthetics as Factors Affecting. W. L. Mendenhall, Boston, Mass. American Journal of Physiology, July, 1915.

Blood, H-ion Concentration in, Studies under Various Abnormal Conditions. M. L. Menten and G. W. Crile, Cleveland, O. American Journal of Phsyiology, August, 1915.

CARBON DIOXID TENSION, ESTIMATION OF IN ALVEOLAR AIR. Paul Roth, Battle Creek, Mich. Journal American Medical Association, July 31, 1915.

CHLOROFORM GENERAL ANESTHESIA, INFLUENCE ON THE RED BLOOD CORPUSCLES. A. Z. Bilina and V. A. Shishoff. Russkiy Vrach, Jan. 3, 10 (Nos. 1-2), 1915.

CHLOROFORM, LATE POISONING: ACID PRODUCTION IN THE LIVER DURING NARCOSIS. Editorial, American Medical Association Journal, July 24, 1915.

COCAINE SOLUTIONS, ARE THEY INJURED BY BOILING? John E. Virden, New York City. American Journal of Surgery, August, 1915.

ETHER, ACTION OF AS AN ANESTHETIC, ON THE DUCTLESS GLANDS. G. Marchetti. Riforma Medica, June 12, 1915.

ETHER, DANGERS ATTENDING USE OF: OBSERVATIONS CONCERNING ITS INFLAMMABILITY. T. L. Deavor, Syracuse, N. Y. American Journal of Surgery, August, 1915.

Ether, Closed and a Color Sign. JOHN BRYANT, Boston, and YANDELL HENDERSON, New Haven, Conn. *Journal American Medical Association*, July 3, 1915.

It will amply repay readers of the SUPPLEMENT to secure reprints of this article and read it in its entirety.

The authors base their views on the simplicity, efficiency and results of the Rovsing method of etherization, which has been in use at the Rykshospital for the past ten years. This method is one of rebreathing, and under it peristalsis of the intestines persists, denoting a proper tension of carbon dioxid, upon which the avidity of hemoglobin for oxygen depends. The danger sign of too much rebreathing is slight cyanosis, and as long as etherization is not complicated by cyanosis but is associated with a pinkish color, it is perfectly safe, and precludes the occurrence of the usual post-operative sequelae of open ether, nauseau, vomiting and gas pains.

The authors also conclude that the advantages of nitrous oxid anesthesia are due to rebreathing, and that these advantages may be secured by closed ether properly administered. They blame postanesthetic complications on intercurrent acapnia, and advise the use of preliminary medication with morphin and atropin and the avoidance of fear and excitement, not only to obviate the bodily changes reported by Cannon, but also to control pulmonary ventilation. They emphasize the fact that pallor under ether anesthesia usually means a depressed circulation because of acapnia and that this condition can be successfully met by limited rebreathing. Excess of rebreathing and deficiency of oxygen are indicated by cyanotic tint; so the rule for the anesthetist is to *keep the patient pink.*

Ethel-Oil Colonic Anesthesia: A Report of Thirty-six Head and Neck Operations, with Special Reference to Ten Thyrodectomies. JOSEPH E. LUMBARD, New York City. *Surgery, Gynecology and Obstetrics*, May, 1915.

Lumbard follows Gwathmey's technic of ether-oil colonic anesthesia, except that he does not use oil for a cathartic or any preliminary bowel medication. He prefers compound licorice powder and irrigation of the bowel with plain water, and advises against the use of soapsuds enema, as the soap will form and emulsion and retard the action of the anesthetic. A large rectal tube and the squatting position materially aid in securing a clean lower bowel. Lumbard prefers a hypodermic of morphin and atropin to the use of chloretone or paraldehyd by rectum. Thirty minutes after the hypodermic the patient is placed on the left side with the knees drawn up, and one fluid ounce of a well shaken mixture of three parts ether to one part of oil, for every 20 pounds of body weight, is administered, through a funnel attached to a well-lubricated rectal catheter. Five minutes should be consumed in administering the mixture. Anesthesia supervenes in from 5 to 20 minutes. If anesthesia is delayed over 15 minutes a few whiffs of nitrous oxid-oxygen or ether should be given or a closed inhaler placed over the mouth and nose to deepen anesthesia. One bag of nitrous oxid will often lengthen surgical anesthesia for one-half hour.

For over-dosage the rectum should be immediately emptied with a large rectal tube having several openings. The operating table should be inclined, head up, while the abdomen is massaged, and a free air way established with a Lumbard controller of the tongue and palate. Should respiration cease use artificial respiration and forced breathing of equal parts carbon dioxid and oxygen.

The rectum should be emptied during the last part of the operation, and the bowel irrigated with tepid water, immediately on the patient's return to bed, until no remnant of the ether-oil remains, after which three ounces of olive-oil are introduced to be retained.

By diminishing the amount of mixture administered in accordance with the age, weight and general condition of the patient, over-dosage may be readily controlled.

The technic is especially valuable in head and neck operations, in which the anesthetist is in the way. In the presence of insanity or nervous tension the patient can be anesthetized without their knowledge; and the dread, usually associated with inhalation methods, is obviated. There is no excessive secretion of mucous, which is a decided advantage in bronchoscopy. The respiration and pulse are more normal than under any other method of general anesthesia. There is less hemorrhage, less tax on the heart, lungs and kidneys. While post-operative nauseau, vomiting and excitement are reduced to a minimum.

The average pulse rate in the 36 cases, including 10 thyroidectomies was 86 per minute; the average respiration 27; while no nauseau or vomiting occurred in 28, or 80 per cent.

Lumbard concludes: "To anesthetize an aggravated case of exopthalmic goitre without the patient's knowledge, maintain surgical anesthesia with a normal pulse and respiration, and keep the upper air passage free from mucous secretions, is one of the most difficult tasks confronting the anesthetist; but it can be done by the ether-oil colonic method of anesthesia. Having had 90 cases (with 18 different surgeons), I feel justified in recommending the extended use of the method in head and neck operations. I have never known of any rectal irritation due to this method."

INTRATRACHEAL INSUFFLATION AND OTHER MEANS OF ARTIFICIAL RESPIRATION. S. J. Meltzer, New York City. Berliner klinische Wochenschrifft, April 26, 1915.

LOCAL ANESTHESIA. J. E. Schmidt, Muenchener medicinische Wochenschrift, May 18 (No. 20), 1915.

LOCAL ANESTHESIA—NOVOCAIN SUPRARENIN INFILTRATION AND CONDUCTION ANESTHESIA IN THE REPAIR OF INGUINAL HERNIA. Isador Seff, New York City. Medical Record, May 29, 1915.

LOCAL ANESTHESIA, PROSTATECTOMY UNDER. C. W. Allen, New Orleans Medical and Surgical Journal, June, 1915.

LOCAL ANESTHESIA, TECHNIC OF IN INTRANASAL SURGERY. W. Wilson. British Medical Journal, June 26, 1915.

LOCAL ANESTHESIA, ADVANTAGES OF COMBINING EPINEPHRIN WITH LONGER ACTING VASOCONSTRICTOR SUBSTANCES, IN. J. BURMANN. Revue Medicale de la Suisse Romands, Geneva, June, 1915.

Local Anesthesia, Modern Methods of Producing, for Dental Operations. HERMANN PRINZ, Philadelphia, Pa. *The Dental Summary*, July, 1915.

It is impossible to do any justice to this exhaustive paper, covering 32 pages with its discussion, by any abstract, and readers of the SUPPLEMENT are advised to secure copies of *The Dental Summary* or reprints from the author, to fully appreciate its merits.

Prinz touches on one subject, however, which is especially worthy of emphasis, and that is the question of obtunding sensitive dentine, and the pulp.

Regarding pressure anesthesia, an analgesic fluid cannot be forced through healthy dentin mechanically without injury to the tooth itself. If a cocain solution is

held in close contact with protoplasmic fibres of the dentin, the absorption of cocain takes place in accordance with the law of osmosis. The inhibition of the anesthetic is enhanced by employing a physiological salt solution as a vehicle. On the other hand, living protoplasm reacts unfavorably against the ready absorption of substances by osmosis for two reasons: (1) Its albumen molecule is relatively large and not easily difusible, and (2) as an integral part of its life it possesses "vital" resistance toward foreign bodies. These latter factors are sufficiently demonstrated by the fact that it is very difficult to stain living tissues. Dehydration of the protoplasm increases the endosmosis of the anesthetic solution markedly.

However, we are able to press fluids quite readily through carious dentin. We must bear in mind that such dentin has been largely deprived of its inorganic salts, leaving an elastic, spongy matrix behind. By drying out this dentin and then confining the anesthetic solution under a suitable water-tight cover, the pressure applied by the finger is quite sufficient to obtain the desired result. Colored fluids may be readily pressed through such dentin and even stain the pulp. In teeth not fully calcified and in so-called soft teeth, pressure anesthesia is more readily obtained, while according to Zederbaum, the process fails in "teeth of old persons, teeth of inveterate tobacco chewers, worn, abraded and eroded teeth, teeth with extensive secondary calcific deposits, teeth whose pulp canals are obstructed by pulp nodules, teeth with metallic oxides in the tubules, or teeth with leaky old fillings—in short, in all instances of clogged tubuli. In such cases no amount of persistent pressure will prove successful."

The pressure which can be produced by a good working, all-metal syringe, holding it between the index and middle fingers and forcing the piston with the thumb, amounts to between 250 and 300 pounds in the average man, and as the pressure required to produce a perfect contact of the anesthetic agent is much less than the above force, high-pressure syringes are not required for this technic.

When the pulp is wholly or partially exposed, the tooth should be isolated with a rubber dam and cleansed with alcohol and water. Excavate the cavity as much as possible and if the pulp is not exposed, dehydrate with alcohol and hot air. Saturate a piece of cotton with a concentrated solution of cocain or novocain, place it in the prepared cavity and cover with a piece of vulcanized rubber and with a suitable burnisher, apply slowly, increasing, continuous pressure from one to three minutes. Then expose and test sensitiveness of the pulp. Repeat the process as indicated.

When the pulp is covered with a thick layer of healthy dentin, use a small spade drill to bore through the enamel or direct into the dentin at a convenient point toward the pulp chamber. Blow out the chips, dehydrate with alcohol and hot air, and apply the syringe provided with a special needle, having as nearly as possible a water-tight point. Apply slow, continuous pressure for from two to three minutes. Then with a round burr the pulp should be exposed, and if still found sensitive the process is repeated.

Recently a method has come into vogue which allows successful obtunding of the pulp by injecting the anesthetic solution around the apex of the tooth. The spongy alveolar process, which contains lymph channels, allows the ready penetration of the fluid. The injection should be made close to the bone, pushing the needle slowly toward the apex, while the fluid is deposited drop by drop. No wheal should be raised by the injection, otherwise the benefit of the pressure from the dense gum tissue is lost. According to Hertwig, the protoplasm of the cell primarily transfers irritation and secondarily transmits absorbed materials. Therefore the anesthetic solution has to pass through the entire dental fibre before the nerve tissue of the pulp proper is reached. Consequently a certain period of time is required before the physiological effect of the anesthetic is manifested. This period of latency depends on the intermediate thickness of dentin or bone. Successful obtunding of the pulp, by this method, depends largely upon the factor of allowing sufficient time for the proper migration, absorption and action of the anesthetic fluid.

Local Anesthesia—Irritation of the Kidneys After Novocain Anesthesia. R. Morian, *Zentralblatt für Chirurgie*, July 10 (No. 28), 1915.

Morian declares that irritation of the kidneys is by no means uncommon after the use of novocain for local anesthesia. In from 5 to 10 per cent. of the cases in which he has used it, albuminuria developed within a few hours and could be detected up to a maximum of 48 hours. The amounts ranged from mere traces to 0.5 per thousand. Formed elements were also present in the urine. The output of urine did not seem to be materially modified by the irritation of the kidneys, but sometimes it was irregular and occasionally scanty. The adult patients had received a hypodermic of 0.01 gm. morphin half and a quarter of an hour before local anesthesia. The albuminuria did not seem to depend on the amount of novocain used or the site of injection. Almost every one of the patients operated on suffered from vomiting, a few hours after the operation. Morian adds that as neither morphin nor epinephrin induce albuminuria, only the novocain can be incriminated.

Repeated tests of blood-pressure under novocain anesthesia showed that the circulation was not disturbed and albuminuria could not be ascribed to fluctuations of blood-pressure. While novocain heretofore has not been credtited with inducing albuminuria, Schwarz, in 1907, reported that he had observed albuminuria up to 7 per thousand after stovain anesthesia.

Magnesium Sulphate Narcosis, Use of in Tetanus. S. J. Meltzer, New York City. Lancet, June 26, 1915.

Military Surgery, Notes on. George W. Crile, Cleveland, O. *Annals of Surgery*, July, 1915.

Some phases of the work of the Lakeside Unit in the American Hospital, Neuilly, Paris, as related by Crile in his "Notes on Military Surgery," are of especial interest to anesthetists. In reference to anesthetics Crile reports that: "Many operations being relatively short and performed on very sick patients—exhausted, exsanguinated, extremely septic-nitrous oxid-oxygen proved to be the ideal anesthetic. The Lakeside Unit took with it a supply of this anesthetic and two anesthetists skilled in its use and administration. Its great advantages were at once so apparent that our anesthetists and the supply of gas were used by the other services, especially in critical cases. Our anesthetists found that the French soldier presented a different problem than the average civilian patient in this country, in this respect, that while the stage of induction was longer and more difficult, after the induction was completed, they required a relatively smaller quantity of the anesthetic and it was easier to maintain a smooth and even anesthesia. A similar difficult induction in our patients at home would indicate a certain amount of alcoholism. It is probable that the more common use of alcohol among the Europeans would account for the general difficulty in anesthetizing patients. This difficulty is even more notably manifested in the use of ether. The French patients responded quickly at the close of operations and many of them were able to walk back immediately to their wards. During the induction of anesthesia patients frequently experienced exciting dreams of battle.

Shock and exhaustion has been so pronounced that post mortem studies have corroborated many of our former experiments on the disintegration of the Purkinje cells caused by the combined effects of emotion, exhaustion, loss of sleep, pain, infection and surgical shock. The liver also showed disintegration of the cells, the loss of cytoplasm and vacuolation. The use of morphin is the onlv readily available method of counteractintg the effects of shock, exhaustion and pain in military surgery, especially in the presence of an overwhelming number of wounded.

Nerve Blocking the Lumbar Plexus: Experiments in. A. Schlessinger. Zentralblat fur Chirurgie, May 29, 1915. (Eo. 22.)

Nitrous Oxid-Oxygen Anesthesia. C. J. Larkey, Bayonne, N. J. New Jersey State Medical Society Journal, June, 1915.

NITROUS OXID-OXYGEN FOR GENERAL ANESTHESIA. H. Risk, Waverly, Ia. Iowa State Medical Journal, June, 1915.

NITROUS OXID AS AN ANESTHETIC. A. E. Baker, Charleston, S. C. South Carolina Medical Association Journal, June, 1915.

NITROUS OXID-OXYGEN ANESTHESIA ANESTHESIA AND ANALGESIA FOR OBSTETRICS, FROM THE VIEWPOINT OF THE ANESTHETIST. E. O. Luther, Chicago. Illinois Medical Journal, June, 1915.

NOVOCAIN AS USED IN SIMPLER NOSE AND THROAT OPERATIONS. E. P. Weih, Clinton, Ia. Iowa State Medical Journal, June, 1915.

OBSTETRICS, ANESTHESIA IN. A. J. Skeel, Cleveland, O. Ohio State Journal, June, 1915.

QUININ AFTER OPERATIONS. Edmond Bonnot and A. H. Cleveland, St. Louis, Mo. Journal American Medical Association, August 7, 1915.

QUININ AND UREA HYDROCHLORID, USE OF IN SCIATICA AND ALLIED CONDITIONS: REPORT OF CASES. H. A. Cables, East St. Louis, Mo. Lancet-Clinic, July 17, 1915.

RESPIRATORY DEAD SPACE. Yandell Henderson. F. P. Chillingworth and J. L. Whitney, New Haven, Conn. American Journal of Physiology, July, 1915.

RESPIRATORY DEAD SPACE, VARIATIONS IN EFFECTIVE. J. S. Haldane, Oxford, Eng. American Journal of Phyiology, July, 1915.

SACRAL ANESTHESIA. P. Bull. Norsk Magazin for Laegevidenskaben, July, 1915.

SALINE INFUSION INTO THE SEVERED FEMORAL VEIN DURING THE COURSE OF THIGH AMPUTATIONS AND HIP JOINT DISARTICULATIONS. M. Savariaud. Bulletin de l'Académie de Médecine.

SHOCK, SOME FEATURES IN SURGICAL. Editorial. Journal American Medical Association, July 24, 1915.

SHOCK, THE SUPRARENAL GLAND IN. J. F. Corbett, Minneapolis, Minn. Journal American Medical Association, July 31, 1915.

SHOCK, AVOIDANCE OF DURING SURGICAL OPERATIONS. L. Guerry, Columbia, S. C. South Carolina Medical Journal, August 7, 1915.

SPINAL ANESTHESIA IN THE CAT. G. G. Smith and W. T. Porter, Boston, Mass. American Journal of Physiology, July, 1915.

SPINAL ANESTHESIA, PROSTATECTOMY UNDER, CASE REPORT. E. S. Breese, Dayton, O. Ohio State Medical Journal, June, 1915.

Stomach, Visible Acute Dilatation of, During Laparotomy. W. H. LUCKETT, New York City. *Journal of the American Medical Association*, June 19, 1915.

Luckett reports two cases of acute, visible dilatation of the stomach during laparotomy due to aerophagy; the air being taken into the stomach through the mouth and esophagus in some modified process of deglutition. Veterinarians are familiar with this condition in horses and cattle irrespective of operative procedures.

One of Luckett's cases was an operation for appendicitis, the other for gastroenterostomy. In both the anesthetic was nitrous oxid-ether, administered with a Bennett inhaler followed by the open drop method.

Common to both cases was a peculiar, rapid noise in the throat, a kind of clonus of the muscles of detection, with a spasmodic deglutition of air (aerophagy); no discoloration of the water in which the stomach tube was submerged. It was a colorless gas that escaped. The stomach was otherwise empty, as no fluid or solid particles escaped through the tube. Neither patient vomited nor had distension after the operation, nor did either of the patients apparently swallow the anesthetic at the beginning of the anesthesia.

It must be understood, as a matter of course, that the stomach always contains a certain quantity of gas, derived partly from gases swallowed with the saliva, partly from gases which pass backward from the duodenum. The saliva contains much more carbon dioxid than an equal volume of venous blood, a part of which is set free by the acids of the stomach. The air in the stomach is constantly undergoing changes whereby its oxygen is absorbed by the blood, and for one volume of oxygen absorbed, two volumes of carbon dioxid are returned to the stomach from the blood. Hence the predominating presence of carbon dioxid in the stomach.

While the increase of this carbon dioxid gas due to the increase in temperature of from 20 to 30 degrees F. above that of the operating-room air, may be a factor in the incidence of acute dilatation, it is more probable that the rapid interchange of gases through the more complex mechanism of the circulation, is the determining factor.

In the author's experience, the black hematogenous and highly toxic material due to some forms of sepsis and intestinal paresis, comes from the mucous membrane of the acutely dilated stomach only after the distension has been maintained for a definite period. The condition, aside from definite pathological causes, occurs in nervous, high-strung, sensitive patients, who are inclined to form and swallow a bolus of air and saliva, if left to their own devices. These patients must be warned of the danger of this procedure, or lavage of the stomach will not prove beneficial.

Although Braun and Riedel, after considerable experimental work could not find evidence of a valvular closure of the cardia, in one instance it was imposisble to empty the stomach by the forcible pressure of four hands; and it spite of our efforts to counteract the erophagy, in this case, more air would enter with each gulp, indicating a valve-like action at the cardia.

The high mortality of post-operative acute dilatation is due to late recognition of the condition. Early emptying of the stomach, before the over-distention injures the capillaries of the mucosa and the consequent filling with enormous volume of highly toxic fluid, will counteract the condition.

The valve-like action of the cardia occasionally yields immediately to the prone position, in which the accumulated gas is rapidly eliminated without use of the stomach tube.

The Editor of the SUPPLEMENT is acquainted with a neurotic patient who can produce an emphysematous condition of the entire body, at will. In connection with post-operative acute dilatation of the stomach it is a pity that the experiments of Hooker in the physiological laboratory of Johns Hopkins University, in respect to the relaxation of the pyloric ring in the presence of ether vapor and carbon dioxid have not been more definitely pursued in the relation of this phenomena to the incidence of acute dilatation during and after operation.

SUGGESTION NARCOSIS. A. L. Beck and A. W. Hoyt, New Rochelle, N. Y. Medical Record, June 26, 1915.

SUGGESTION AS AN AID IN EVERY-DAY DENTAL PRACTICE. W. E. Hoffman, New Jersey Dental Journal, August, 1915.

SURGICAL SHIBBOLETHS. J. Ransohoff, Cincinnati, O. Ohio State Medical Journal, July, 1915.

TWILIGHT SLEEP—SCOPOLAMIN AND MORPHIN IN OBSTETRICS AND SURGERY. R. T. Gillmore, Chicago, Ills. New York Medical Journal, August 7, 1915.

TWILIGHT SLEEP—SCOPOLAMIN-MORPHIN-COCAIN IN SURGERY. A. G. Brenzier, Charlotte, N. C. New York Medical Journal, June 12, 1915.

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